**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC 20554**

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| In the Matter of | ) | |
| | ) | |
| Healthy Heavens Trust Initiative | ) | |
| Global Network Against Nuclear Weapons and Power in Space | ) | |
| Americans for Responsible Technology | ) | File No. RM-_____ |
| Safeguarding the Astronomical Sky Foundation | ) | |
| | ) | |
| Petition for Emergency and Expedited Rulemaking | ) | |
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To: The Secretary of the Commission

**PETITION FOR EMERGENCY AND EXPEDITED RULEMAKING**

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James S. Turner
Swankin & Turner
5614 Connecticut Ave., NW #339
Washington, DC 20015
jim@swankin-turner.com
Mobile: 202-462-8800

Julian Gresser, Of Counsel
Swankin & Turner
P.O. Box 30397
Santa Barbara, CA 93130
juliangresser77@gmail.com
Office: 805-563-3226

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## I. SUMMARY

During the past four years, and at an accelerating pace, the FCC has been granting *carte blanche* blanket licenses to a small group of satellite companies for 80,000+ low orbit, non-geostationary satellites, and millions of earth stations. This major federal program is being conducted by the FCC as the lead agency in a piecemeal fashion, without any apparent rules or regulations to limit the national and international security risks that its actions are causing. There has been little or no effective consultation with at least ten other federal agencies, international organizations, and other nations whose jurisdiction, missions, and strategic interests are being jeopardized. Because the satellite companies are unable to obtain insurance for most of these risks, and are unwilling to indemnify injured parties, the national and international community are being required, without informed consent, to bear virtually all the risks and costs (Public Pays Principle).

This Petition for Emergency and Expedited Rulemaking requests a 180 Day Pause on the "Satellite Experiment." It is a foreseeable and avoidable catastrophe just waiting to happen. And the Petition offers a practical remedy. The FCC, other concerned U.S. government agencies, and the Congress have a unique opportunity to enlist the best expertise within the public and private sectors to conduct a comprehensive and systematic assessment of the risks, illustrated in Figure #1 and #2, as required by international and federal law. Based on a full assessment of these risks, the FCC and the larger community of stakeholders will be far better prepared to produce new rules and regulations to understand, mitigate, and avoid them.

**A Balanced Path**

This Petition recognizes the technological and entrepreneurial virtuosity of the proponents of the Satellite Experiment, and the putative benefits that they are claiming. At the same time, the Petition vigorously points out the immediate advantages of a proven, tested, safe, and secure alternative — Wired Broadband or Optical Fiber to the Premises (FTTP) — which the FCC has largely ignored in its haste to favor satellites. Petitioners have drafted and are attaching examples (Appendix 5) of the most urgently required new rules that will assist the Biden Administration and the international community in charting a balanced path forward.

**Comprehensive Risk Assessment.** In collaboration with other federal agencies and concerned international organizations, the FCC must prepare a Comprehensive Whole System Risk Assessment; the process must be transparent, including public briefings and hearings. As a condition of all future licenses, the FCC and applicants must make a finding of consistency with the Comprehensive Risk Assessment and implementing regulations.

**Collisions.** The FCC must produce a Plan, requiring applicants to adopt measures to reduce significantly the risks of collisions from orbit overcrowding, space debris, elevation modifications, and operations. Security bonds commensurate with the risks and properly designating beneficiaries will be required. Sign off by NASA and other lead agencies will also be required on all new licenses. The FCC will withdraw its disclaimer for U.S. responsibility under the Outer Space Liability Convention.

**Cybersecurity.** The FCC must recognize and defer to the primary authority, jurisdiction, and expertise of the Cybersecurity and Infrastructure Security Agency, the National Security Council, and the White House's Office on Science and Technology Policy. Cybersecurity

clearance must be obtained by satellite companies on all applications. The FCC must adopt and incorporate into its new rules the European General Data Privacy Regulations (GDPR).

**Environmental and Health Impacts.** The FCC must cancel its categorical exemption from the National Environmental Policy Act and prepare a Comprehensive Programmatic Environmental Impact Statement and detailed regulations on the wide ranging environmental and health concerns presented by its piecemeal blanket licenses.

**Wired Broadband.** Based on its Comprehensive Environmental Impact Statement, which must include a careful and thorough cost/benefit analysis of Wired Broadband, the FCC will postpone implementation of its grant of $886 million to SpaceX, pending consideration of public benefits of immediately available alternatives. The FCC will verify that SpaceX can actually deliver the benefits to rural communities that its application is promising.

**Dual Use Technologies and Accelerating Space Conflicts.** In close coordination with other major federal agencies with primary jurisdiction and domain expertise, the FCC will conform and incorporate into its new rules the current controls of the export and reexport of sensitive dual use products, technologies, software, and data, as are currently being administered by the Department of Commerce. The FCC will strongly support a vigorous initiative led by the State Department to negotiate an East Asia Regional Compact signed by China, Japan, South Korea, and Taiwan to ensure the peaceful exploration of Outer Space on behalf of all living creatures and future generations.

## II. INTRODUCTION

This Petition for Emergency and Expedited Rulemaking seeks a 180 day PAUSE on the FCC's blanket licenses to a few satellite companies for 80,000+ satellites and millions of earth stations. The Proposed New Rules are set forth in detail in Section V below, and in Appendix 3.

The New Rules address and offer a solution to a complex interagency organizational challenge facing the Biden Administration. They are predicated on the fact that the FCC is acting unilaterally and as the self-appointed lead agency on all matters relating to the launch and deployment of commercial satellites, notwithstanding that its blanket licenses to satellite applicants encroach upon the core missions and jurisdictions of many other federal agencies. The FCC's assertion of primary jurisdiction and the significant national and international security risks its own actions are engendering necessitate the systematic matrix of decision-making Petitioners are proposing. In plain terms, Petitioners respectfully urge that the FCC must not continue to make, indeed must not seek to accelerate critical decisions involving satellites that deeply concern many other federal agencies, and then at the same time backtrack to claim, as it currently is, that it lacks domain expertise and authority to make these same decisions. This Petition for Emergency/Expedited Rulemaking offers a practical solution which Petitioners believe can be of immediate use and benefit to the new Biden Administration.

The Petition rests on six stark Propositions:

**First**, the FCC's program of arbitrary and piecemeal blanket licenses, granted primarily for the narrow commercial benefit of a few powerful satellite companies, presents unique, largely unexamined national and international risks, as described in Figures #1 and #2, that require immediate consideration by the FCC, the Biden Administration, the Congress, and the international community. Of all these risks, Cybersecurity presents perhaps the most immediate, urgent, largely unattended danger that is recognized by experts across the political spectrum throughout the U.S. government and in the private sector. The challenges of Cybersecurity must be addressed and satisfactorily resolved before the FCC's program can be permitted to continue, at least at its current pace.

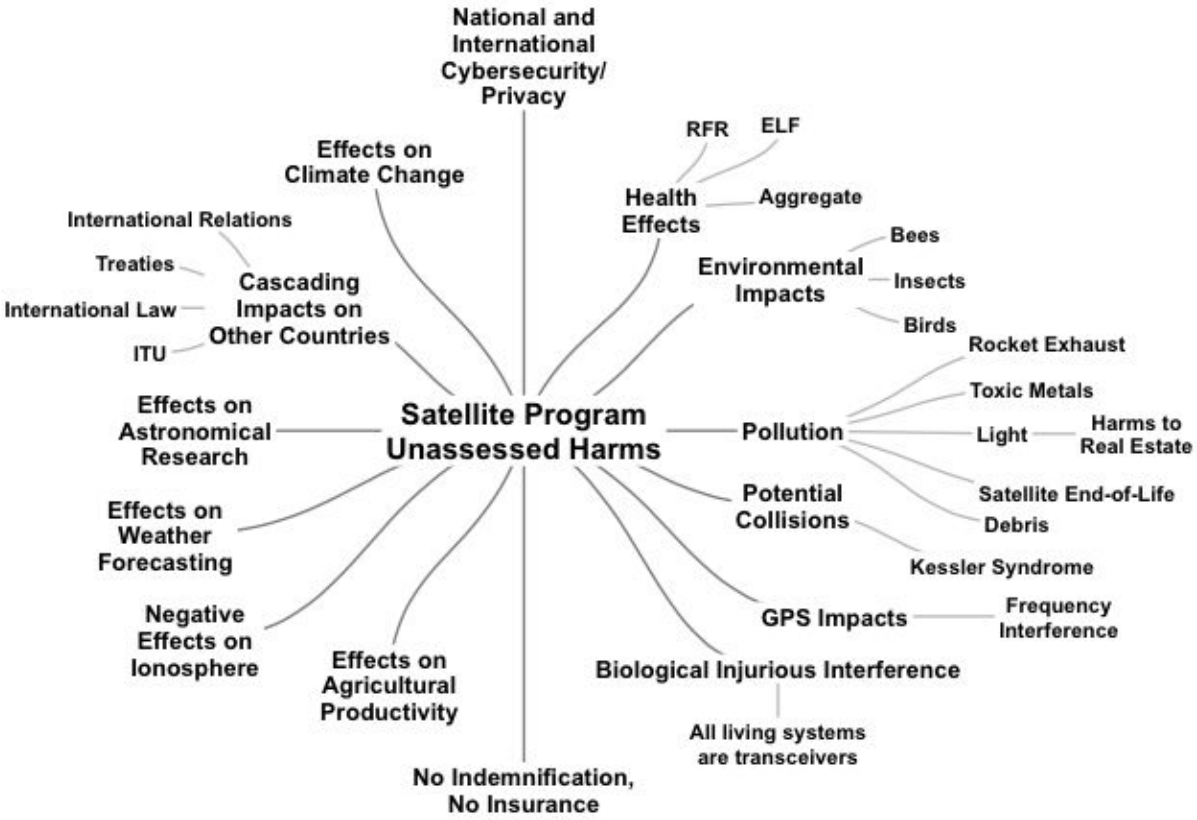


Figure #1 — Satellite Program Unassessed Harms

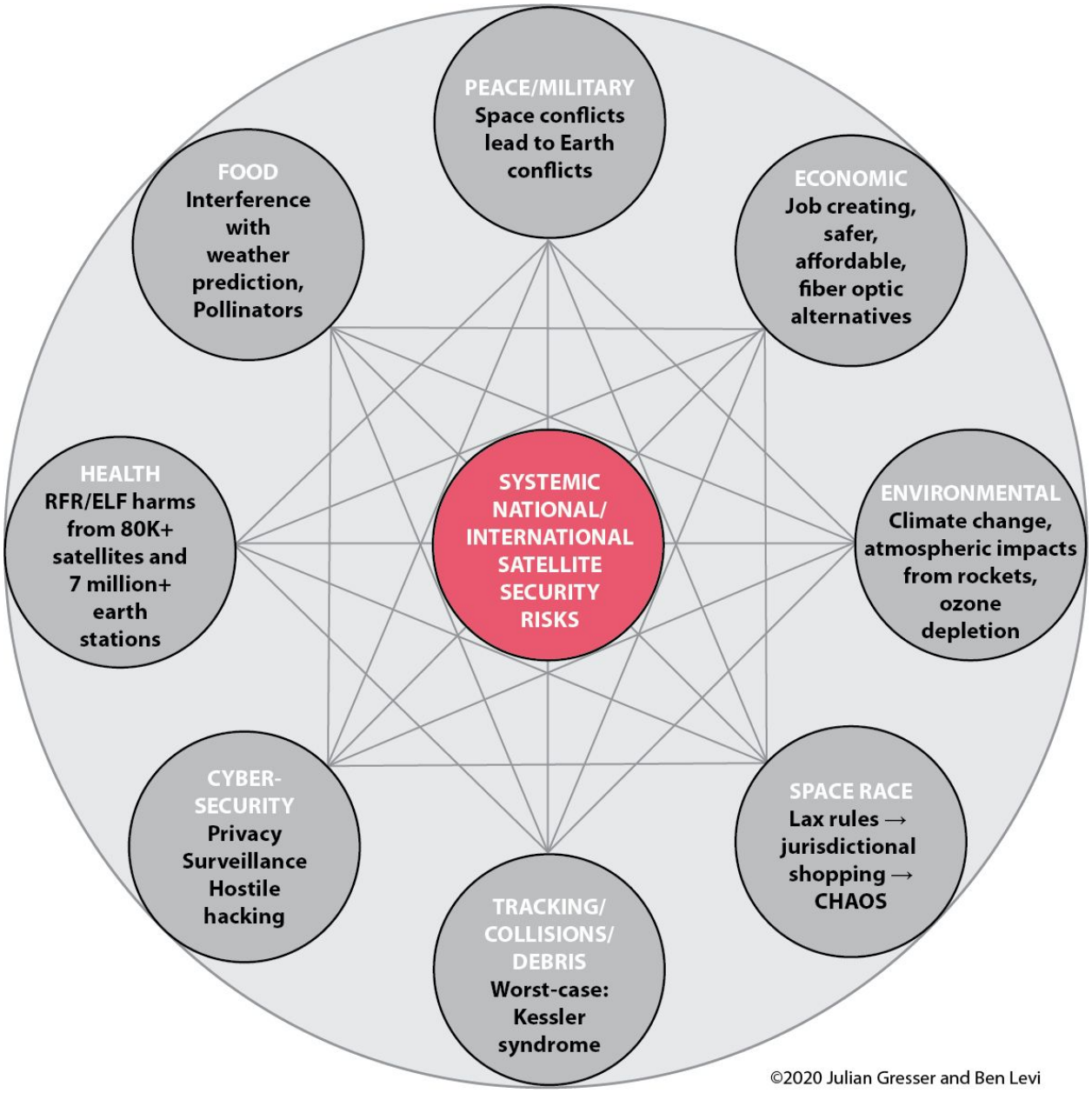


Figure #2 — Systemic National/International Satellite Security Risks

**Second**, the Heavens (Outer Space) are held in sacred Public Trust for present and future generations of humanity, and for all living creations. Humans are stewards and fiduciaries of this sacred Trust. The Heavens are not a "thing" or a "commodity" — an inanimate legal fiction like a ship or a corporation — to be owned, conquered, exploited, manipulated, turned into a battlefield, and despoiled.

**Third**, commercial exploration of the Heavens must proceed with balance, precaution, foresight, and wisdom. It must be guided by an accurate prior assessment of the risks, and a clear headed and transparent analysis of who actually benefits, and who is being asked to pay for the likely harms of what is essentially a business experiment ("Satellite Experiment").

**Fourth**, there exists an immediate, tested, proven, safe, secure, environmentally protective, energy efficient, far more economical, indeed massively job-creating alternative to the Satellite Experiment. That is optical Fiber To The Premises (FTTP). Much of the existing fiber infrastructure in the U.S. hasen has already been paid for by taxpayers and communications ratepayers. It is scarcely being considered in the mad Space Race the FCC is enabling.

**Fifth**, the FCC's unregulated*, carte blanche* blanket satellite licenses are setting the stage for fast-approaching Space Wars, in particular the risks of direct military conflict with China. The Biden Administration can effectively address this challenge by imaginatively engaging the principal concerned countries in the East Asia Region—China, Taiwan, Japan, and South Korea. The FCC's new Rules must reflect and support these diplomatic negotiations, not run in conflict with them.

**Sixth**, the FCC must comply with the existing U.S. international treaty obligations, U.S. federal and state laws, and the laws of other nations, which it is largely ignoring and, in some cases, openly defying.

**Remedy: 180 Day Pause**

Petitioners are requesting a 180 Day PAUSE on all satellite launches, spectrum sales or allocations, earth/base station approvals or modifications, and grants to satellite companies that are designed to accelerate new deployments in Outer Space or on Earth, until the results of the present "beta tests" are carefully analyzed. The FCC has a legal and public obligation to discuss the results from these beta experiments with all concerned federal and state agencies, and to hold public hearings with transparent explanations on the direct and indirect taxpayer-funded and regulatory subsidies the satellite industry is requesting the public to pay, to enable these few companies to continue their enormously risky and costly experiment.

**Why Time is of the Essence**

Other agencies of the U.S. government as well as international organizations have already warned the FCC, expressing their dismay that the agency is cavalierly ignoring imminent risks to national and international security — for example, concerning collisions, debris, and Cybersecurity. In fact, the agency, in open defiance, is actively augmenting the dangers by **streamlining the approval process**.

Petitioners contend the FCC's overall satellite program is a major federal action which will have catastrophic international and planetary consequences; that it directly violates a large number of federal laws and other nations' laws, as well as international treaties, UN Declarations, and policy statements from other international organizations governing the commercial exploitation of Outer Space.

## III. SUMMARY OF INTEREST

Petitioners include a diverse group of international organizations, representing thousands of members around the world, whose core missions concern eight domains of national and

international security risks. As detailed below, ninety-five of these organizations from sixty-three countries as of this date have signed the attached Healthy Heavens Trust Initiative Declaration expressing their grave concerns, and attesting to the fact that their interests and those of their members will be immediately, measurably, and profoundly harmed, unless and until the FCC adopts effective Rules to control and to mitigate these risks.

Petitioners and their allied team at the BALANCE GROUP have previously sought relief from the FCC in an Application for Review of the International Bureau's decision to extend a blanket license to SpaceX for one million earth stations (March 13, 2020); and in another challenge to the International Bureau's precipitous decision in a single day, without proper notice or public hearing, to allow SpaceX a drastic modification in elevation of over 4,000 Starlink satellites (May 27, 2020). Petitioners have not yet received a reply to the Application for Review, and on January 8, 2021 the International Bureau took action on the challenge to SpaceX's elevation modification, granting it in part and deferring other applications. The FCC's policy of intentional neglect is enabling the satellite applicants to establish legal expectations and effectively to impose a *fait accompli*.

Petitioners are **urging the FCC to adopt a reasonable and balanced approach**. Petitioners recognize that some satellite companies have already invested billions of dollars in existing satellite constellations and earth stations. So long as the FCC requires proper indemnification and insurance to compensate the public for any damages from these existing deployments, the FCC can reasonably permit the applicants to continue to operate existing orbiting satellites and to gather data critical for assessing their impacts in all of the domains mentioned herein. But it must recognize these projects for what they are — beta versions for essentially unproven, highly risky, energy inefficient, inordinately expensive, experimental

technologies. Petitioners have waited patiently for over ten months for the FCC's response to their Application for Review. The agency's silence and inaction in open defiance of international, federal and state laws, and the laws of other countries is itself a major federal action. As with the granting of thousands of piecemeal licenses, the FCC's failure to act is compounding the risks noted, and must be immediately and urgently reviewed under the standards of the Administrative Procedure Act, the National Environmental Policy Act, and other federal statutes.

## IV. JURISDICTION

This is a Petition for Emergency and Expedited Rulemaking pursuant to FCC Rule 1.401(a-c), 47 CFR Ch. II (10–1–19 Edition) 202.0 objectives, 202.1 policies, Sections 202.0-202.3 which pertain to the allocation of functions and responsibilities for non-wartime emergencies within the federal government — Emergency Preparedness and Planning during National Emergencies occurring in war as well as peacetime. These Rules make clear that the locus of authority in national emergencies involving telecommunications infrastructure resides in the National Security Advisor and Director of the White House's Office of Science and Technology Policy (OSTP), not the FCC.[1]

Section §202.2 (a) states:

> (a) The preservation of the integrity of characteristics and capabilities of the Nation's telecommunications systems and networks during wartime or non-wartime emergencies is of the utmost importance.

At a bare minimum, the federal regulations for non-wartime emergencies require that the FCC consult closely with the National Security Council, the White House Office of Science and Technology Policy and other concerned agencies identified in this Petition to ensure that the

[1] Petitioners are aware that the Biden Administration is reorganizing Space Policy and placing primary jurisdiction in the National Security Council.

FCC's present and future Rules reflect consideration of national emergencies. As outlined in this Petition, the FCC has not taken even the most basic precautions to consult with the National Security Advisor and the Director of the OSTP to address the very risks that its own actions are causing. Petitioners are not aware of any formal sign-off by the National Security Advisor, the Director of the Office of Science and Technology, or secretaries or administrators in other agencies, such as CISA, NIIST, NASA, DOS, DOD, GOA, DOA, DOE or EPA, that have statutory jurisdiction and authority. The eight domains of security risks described herein have not to date been carefully scrutinized in oversight hearings by any Congressional Committee.

## V. PETITIONERS

Petitioners are all organizations whose mission and purpose directly concern and will be jeopardized by the national and international security risks resulting from the FCC's current piecemeal blanket licensing of 80,000+ satellites and millions of base/earth stations. Petitioner Health Heaven's Trust Initiative (HHTI) is an umbrella organization dedicated to preserving the Public Trust in the Heavens for the benefit of humanity and the living natural world. HHTI has produced a Declaration which is signed thus far by over 3,500 concerned global citizens, and over 100 organizations, in more than 60 countries, concerned with international peacekeeping, international human, health, and environmental rights. (Please see list of organizations attached.) The Declaration has been translated into Swedish, French, Italian, and Japanese.

Petitioner Global Network Against Nuclear Weapons and Power in Space (GN) was founded in 1992, at that time headquartered in Central Florida. The organization is made up of 150 local organizations across the US and around the world representing thousands of members. GN's core mission is to prevent the nuclearization and weaponization of space, and to protect the space environment from devastation. These concerns are well expressed in an award winning

documentary, *Pax Americana & the Weaponization of Space*. Its members are also particularly concerned about the growing problem of space debris and the implications for life on Earth, given that so much of human activity relies on satellites that are increasingly in grave danger from destruction by debris fields in orbit. (See Declaration of Bruce Gagnon, GN Founder and Coordinator). GN's legal standing as a pioneer for peaceful uses of Outer Space has been previously recognized by the federal courts in prior litigation.[2]

Petitioner Americans for Responsible Technology (ART) is a non-profit organization dedicated to wise, responsible, and compassionate uses of technology. Its core mission is dedicated to safeguarding the health, safety, security, privacy and property values of our fellow Americans. Its founding principles endorse independent, peer-reviewed and published science unencumbered by industry influence, and a moral obligation to protect the next generation. The efforts by a few satellite companies, enabled by the FCC and financed by public funds and a permissive regulatory regime, with the goal of dominating Outer Space for private commercial advantage, all heedless of the tragic planetary consequences, exemplify the very egregious and irresponsible uses of technology that ART was established to address.

Petitioner Safeguarding the Astronomical Sky Foundation (SASF) is a non-governmental non-profit organization established under the laws of Italy. Its mission is to protect the interests of astronomers around the world whose scientific research and livelihood is being jeopardized by the full-scale licensing by the FCC of thousands of low-earth-orbit (LEO) and very-low-earth-orbit (VLEO) satellites. SASF builds upon the International Appeal of more than two thousand astronomers from more than 50 countries, which is incorporated herein by

[2] Petitioner has a long-standing commitment of challenging reckless satellite launches. One example is the lawsuit brought by Petitioner's predecessor organization, whose standing was recognized by a federal court in an action seeking an injunction against the Cassini Mission (1987). See Hawai'i County Green Party v. Clinton, 980 F. Supp. 1160 (D. Haw. 1997).

reference. SASF is composed of several associations from different countries around the world, which includes professional and amateur astronomical associations, as well as environmental non-profit unions. Many of SASF's associates have specific research contracts whose benefits will be immediately and measurably impaired by the FCC's reckless blanket licenses, being granted without any serious regard for the adverse impacts on astronomical science, giving lip service to astronomers' concerns, but plowing full speed ahead anyway. The world stands at the threshold of extraordinary new discoveries in astronomy and cosmology. SASF seeks to prevent an irreversible loss of this inestimable treasure for present humanity and future generations. (See Appendix 4 for further background on SASF and the International Appeal by Astronomers, and the Declaration by SASF's president, Dr. Stefano Gallozzi.)

## VI. SUMMARY OF PROPOSED NEW RULES

**Proposal #1: Comprehensive and Systematic Risk Assessment.** The FCC must conduct a Comprehensive and Systematic Risk Assessment, in consultation with other federal agencies and international organizations, drawing upon best available methodologies and practices. Of all the risks noted in this Petition the most immediate, intractable, unassessed, and dangerous is Cybersecurity. The unaddressed Cybersecurity risk alone justifies the requested FCC's Emergency/Expedited Review and Rulemaking.

**Proposal #2: Satellite Collisions.** The FCC must develop new Rules to address the national and international security risks of satellite collisions, including accidents resulting from space debris.

**Proposal #3: Cybersecurity.** FCC's permissive satellite licensing program is currently violating various laws and policies safeguarding Cybersecurity and jeopardizing national and

international security. The FCC must condition new licenses based on Cybersecurity clearance from other agencies with domain expertise.

**Proposal #4: Environment and Health.** The National Environmental Policy Act (NEPA) and other federal statutes, international environmental and human rights treaties and conventions signed and ratified by the United States, and international customary law require the FCC to consult with other concerned U.S. federal agencies and the international community of nations, and to adopt new Rules for licensing satellites and earth stations based on a careful assessment of the environmental and health impacts within the U.S., in other countries, and affecting the global environment.

**Proposal #5: Wired Broadband.** In meeting the Digital Divide Challenge, the FCC must support local municipal ownership, control and decision making of internet infrastructure; and do so in a way that does not discriminate against alternative optical fiber wired solutions that are safe, secure, energy efficient, environmentally protective, and less wasteful of taxpayer monies.

**Proposal #6: Strengthening Export Controls to Reduce Military Conflicts in Space.** The FCC must develop special Rules and precautions to resolve the unaddressed risks of space militarization by dual use strategic technologies. In order to avoid a Space Race leading to Space Wars, the FCC must coordinate closely with the Department of Commerce, the Department of State, NASA, DHS, Cybersecurity Infrastructure Agency, EPA, DOA, FEMA, and other federal agencies, in initiating negotiations with other governments, beginning with China, that are actively pursuing aggressive programs to exploit and to militarize Outer Space.

## VII. BACKGROUND FOR PROPOSED REVISIONS AND NEW RULES

**Proposal #1: Comprehensive and Systematic Risk Assessment.**

**Summary**

The FCC's satellite/earth station licensing program presents compounding layers of national and international security risks, illustrated in Figures #1 and #2.

None of these risks have been addressed or evaluated individually or systematically, let alone incorporated in the Commission's Rules as pre-conditions of licensing. We urge the FCC to develop within 180 days a comprehensive program and new Rules, based on close consultation with all other concerned federal agencies, to assess and to measure these risks. Under the FCC's proposed new Rules and Regulations, satellite companies would be required to prepare and to submit a Plan on how they will mitigate these risks and compensate victims for the resulting harms.

**Essential Security Challenge**

Figures #1 and #2 present an overview of eight fundamental national and international security risks that Petitioners allege are not being addressed by the FCC in its present Rules and Regulations. Each risk domain urgently requires specific focus. However, what is missing is a **comprehensive and systematic assessment** of how each domain of risk interacts with all others in negative synergy. The FCC's failure to address these risks will with high probability result in a cascading and compounding Negative Resilience Multiplier, whereby any catastrophic event in any risk domain will activate, compromise, and undermine the adaptive capacity of each and all the others, so that the integral resilience of the entire system to cope and to recover is impaired; in effect, a massive breakdown in the resilience[3] of the entire system. The adverse

[3] Julian Gresser — Integral Resilience — Helping Communities Thrive.

impacts in Outer Space and on Earth must be analyzed together as a **single system.** As the responsible parties for causing this havoc, the satellite companies must be held to their legal obligation to provide essential information to the FCC and other agencies to support an interagency process of risk assessment. As set forth below, the proposed new Rule will make the details of this obligation explicit.

**Who Pays?**

The satellite companies are requesting billions of dollars in taxpayer/ratepayer subsidies, and trillions of dollars in indirect subsidies in the form of permissive regulations, whereby the risks and harms of the Satellite Experiment, noted in the eight domains above, are assigned and imposed upon an unsuspecting public, without indemnification, insurance, or informed consent.

**Present Rules — Their Defects and Consequences**

At present the FCC has not issued comprehensive Rules or Regulations addressing the systemic risks of its piecemeal satellite/earth station program. Without any scientific basis for its arbitrary actions, and in the face of expressions of grave concern from other agencies that actually possess extensive domain expertise and experience, the FCC persists in implementing a program of blanket licenses to satellite companies without any requirement for accountability to other agencies of the administration, the Congress, much less the unaware public.

**Best Risk Assessment Methodologies and Practices**

In fact, there is a great body of practice and expertise on risk assessment that can be productively applied in the context of the Satellite Experiment, once the FCC decides to tap it.

**Coordinated Planning with Other Concerned Agencies**

Appendix 5 provides an overview of Mission statements of many other federal agencies that have jurisdiction, missions, and domain expertise that are directly relevant and with which

the FCC must consult as specified in the Proposed Rules. Together with these agencies the FCC as the self-appointed lead agency must engage in a comprehensive interagency review of the risks of the Satellite Experiment. There is no evidence to date that the FCC has even performed, much less published, such a comprehensive risk assessment.

**Applicable Laws and Rules Governing Risk Assessment**

The FCC's legal obligation to perform the requested risk assessment is contained in a number of federal statutes which should be construed and applied together. These include: the Administrative Procedure Act, the Secure 5G and Beyond Act and the National Strategy to Secure 5G Implementation Plan (Jan. 6, 2021) produced under the direction of this Act, the National Environmental Policy Act, among others. Congress regularly requires federal agencies to engage in risk assessment as part of their core duties to the citizenry. A Report reviewing all these laws is available here.

The FCC's blanket licenses to a few satellite companies is generating a plethora of high level national security risks that directly involve the risk management programs of other federal agencies that already have in place best practice guidelines and regulations. For example, NOAA has in place recommended best practices on risk management relating to weather forecasting which, as explained below, may be directly affected and interfered with by satellites. There is a special Risk Management Agency within the Department of Agriculture to address risks and calamities for farmers.

There is no public evidence that the FCC has meaningfully consulted with NOAA on the potential impact of 80,000+ satellites on weather prediction, nor the FDA on food production, both major and immediate national security concerns. Each of the proposals noted below point

out similar failings, beginning with the clear national security risks of collisions, debris, and breaches of Cybersecurity.

**Summary of Proposed New Rules and Regulations**

At present the FCC does not have any Rule or Regulation addressing the necessity of comprehensive interagency risk assessment, which is the substance of the Proposed New Rule. As noted, it is urged this Rule include a provision to require satellite companies, as a pre-condition of any license, to provide their own risk assessment, mitigation, indemnification, and insurance plans under penalty of perjury. Applicant risk assessments must contribute to and be reasonably consistent with the overall planning process and Risk Management Plan produced by the FCC and based on the Comprehensive Risk Assessment.

In fact, the FCC's new proposed Streamlining Licensing Procedures for Small Satellites is moving in precisely the opposite direction from what is required, in light of the risks to national and international security. **What is required is a prudent pause, not accelerated streamlining. The enforcement of the new FCC streamlining Rule must be reconsidered.**

**Important Policy Questions**

- What is at stake if the FCC and other agencies fail to address the national and international security risks of approving blanket licenses for 80,000+ low orbit satellites and millions of earth stations without any coherent and comprehensive plan?
- What are the likely costs to the public of a single major accident, as might have occurred over Pittsburgh in January 2020, much less a systemic breakdown without proper indemnification or insurance?
- What other federal and state agencies, or international organizations possessing critical domain expertise must be consulted by the FCC as the lead agency?

- What factual information should applicant companies be required to supply under penalty of perjury?
- What are the measurable economic and other benefits to the U.S. and the international community that the FCC, with support of the Biden Administration, can immediately generate by positively cooperating with other agencies in producing and widely sharing its Comprehensive Risk Assessment?

**Proposal #2: Satellite Collisions. The FCC must develop new Rules to address the national and international security risks of satellite collisions, including accidents resulting from space debris[4] and meteors.[5]**

**Summary**

In January 2020, two dead satellites came within 60 feet of colliding over Pittsburgh. The damages in terms of loss of life and property losses could have been in the billions of dollars. This near-miss is only the latest incident in a long history of actual collisions, some documented and others classified. The massive increasing amounts of space debris[6] is dramatically increasing the probability of a catastrophic collision, as predicted by the Kessler Syndrome. According to one source,[7] space debris travels at a relative velocity approaching 18,000 miles per hour. NASA has expressed its grave concern in a letter from Samantha Fonder,

[4] For a real-time depiction of all of the space debris currently being tracked, see AstriaGraph, a public-domain website. To see all of the debris, click the box to Show Debris. Caveat: Each dot representing an object is much larger in size on the screen than the actual object. However one could imagine with accurate enough tracking technology, and the ability to speed up to predict the future, such technology could — and likely is — being utilized to predict collisions. See next footnote.

[5] See, e.g. Shooting Stars Can Shoot Down Satellites.

[6] "In 2017, the U.S. government reported that it logged 308,984 close calls with space junk and issued 655 'emergency-reportable' alerts to satellite operators." That's an average of 846 close calls every day, and 2 alerts per day to satellite operators. And that was before Starlink, etc. (an additional 1,000+ satellites have been launched since 2017).

[7] See Space Debris Remains Ongoing Concern for Landsat

NASA Representative, to the Commercial Space Transportation Interagency Group. The FCC appears to have ignored NASA's urgent warning and appeal, and certainly has not adopted new Rules as proposed in this Petition to address this national and international security risk.

A related concern is meteors. Every day more than 100 billion meteoroids larger than one microgram enter the Earth's atmosphere. Although the vast majority of meteoroids are scoured away to nothing by friction with the Earth's atmosphere, some get through and pose a significant risk to satellites. The above cited meteor study suggests that the typical speed of a meteoroid smaller than 50 micrometers is 60 km/s which is more than sufficient to puncture a hole in a satellite.

**Essential Security Challenge**

Satellite collisions are not imaginary. They present an immediate risk of catastrophe that has already occurred on numerous occasions and will certainly increase in the near future as space traffic increases. The FAA has expressed concern over the interference of 5G with airplanes. Of special concern is the FCC's plan to redeploy spectrum for 5G wireless networks which could interfere with electronics used by aircraft as they land. The FCC does not appear to have considered the hazards of burned out satellites that could cause serious damage to orbiting satellites, as the debris falls to Earth through the atmosphere. The rapid proliferation of nano-satellite launches may significantly increase the existing risks of accidents[8] involving larger satellites and aircraft. The FAA has recently expressed its concern over the FCC's failure to address the real risks of altimeter interference on aircraft navigation.

[8] Stanford Professor Ingrid Close warns of the increasing risks of meteors striking satellites. She writes, "Every day, more than 100 billion meteoroids larger than one microgram enter Earth's atmosphere, traveling at more than 11 km/s. The FCC has not addressed, much less assessed this additional risk in its blanket licensing program." See Shooting Stars Can Shoot Down Satellites.

A new and complicating factor is the proliferation of High Altitude Platform Stations (HAPS), operating in the stratosphere at an altitude around 20 km. HAPS will likely become an integral component in the emerging Earth/Satellite wireless infrastructure.[9]

**Who Pays?**

Article 7 of the Convention on International Liability for Damage Caused by Space Objects provides that a launching State shall be absolutely liable to pay compensation for damage caused by its space objects on the surface of the Earth or to aircraft, and liable for damage due to its faults in space. The FCC has published a policy statement taking the position that the U.S. will not be liable for accidents resulting from satellite operations. The FCC's apparent rationale is that the FCC is a regulatory not a statutory agency, and thus (presumably) lacks Congressional authorization for the licenses it is approving (at least as far as the Convention is concerned). In effect, the FCC is abrogating U.S. responsibility under the Convention, and thereby assigning the risks of billions of dollars of costs of catastrophic accidents to be borne by a hapless and unconsenting international public, without provision for indemnification, insurance, or fair compensation.

**Present Rules — Their Defects and Consequences**

The present FCC standard regarding catastrophic events such as satellite collisions is permissive, arbitrary, and patently inadequate.[10] The obligations to mitigate these risks and responsibility for harms placed upon applicants are minimal. Other agencies, for example the French Space Agency, are developing new protocols using machine learning in light of a recent near collision over France. The FCC's proposed Rule states:

> 3. Casualty Risk Assessment (FCC 18-159 NOTICE OF PROPOSED RULEMAKING AND ORDER ON RECONSIDERATION)

[9] See e.g. HAPS Networks of the Future, Figure 1.
[10] The FCC's Rule 19-81A1 cites a maximum of $5 million surety bond.

> 60. The U.S. Government Orbital Debris Mitigation Standard Practices and the NASA Standard include a policy of limiting to 1 in 10,000 the risk of at least one human casualty, anywhere in the world, from a single, uncontrolled reentering space structure. In order to assist the Commission in evaluating the spacecraft design with respect to human casualty risk, we propose two specific informational requirements for satellites with a planned post-mission disposal of uncontrolled atmospheric re-entry.
>
> 61. First, we propose that the human casualty risk assessment include all objects that would have an impacting kinetic energy in excess of 15 joules. This is consistent with the NASA Standard, wherein the potential for human casualty is assumed for any object with an impacting kinetic energy in excess of 15 joules.
>
> 62. Second, we propose that where the calculated risk of human casualty from surviving debris is determined to be greater than zero, as calculated using either the NASA Debris Assessment Software or a higher fidelity model, the applicant must provide a statement indicating the actual calculated human casualty risk, as well as the input assumptions used in modelling re-entry. We tentatively conclude that these additional specifications will enable the Commission to better evaluate whether the post-mission disposal plan is in the public interest and seek comment on this approach. We further invite comment on whether, when assessing human casualty risk, we should do so on an aggregate, system-wide basis as well as on a per-satellite basis, and, if so, what metric should be used to evaluate aggregate risk.

**FCC Present Regulations relating to Liability**

The position of the FCC on liability is contained in Section G, Paragraphs 76-81 in the FCC Proposed Rulemaking above. Although the agency wisely addresses the necessity of requiring applicants to sign an indemnification agreement and to provide proof of adequate insurance coverage for accidents, Petitioners cannot find any implementation of this sensible proposal by the agency. To the contrary, the Commission's current position is contained in the following statement in Paragraph 77:

> As part of this general update of our rules related to orbital debris mitigation, we now revisit the topic of liability. In so doing, we note that the Commission is a regulatory agency, and unlike agencies with statutory authority to conduct space operations, cannot accept risk on behalf of the United States by virtue of undertaking those operations. Our review of an applicant's debris mitigation plan, or grant of a license, does not alter any liability of the applicant or licensee.

In plain terms, the FCC is abrogating any treaty obligations by the U.S. for accidents it is permitting, while at the same time in other sections of the proposed Rules giving the applicant satellite companies a pass. The international public is being asked to shoulder the entire risk and costs of accidents.

**Applicable Laws**

The most directly applicable source of international law is the Convention on International Liability for Damage Caused by Space Objects. Article II clearly states:

> A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight.

Further, Article VII of the UN Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies clearly states:

> ARTICLE VII
>
> Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.

These international obligations of the U.S., based on treaties signed and ratified by the U.S. and international customary law, cannot be abrogated simply because the FCC decides arbitrarily and capriciously to ignore them, or by the specious excuse that because it is a "regulatory agency" and not a "statutory agency" it has no legal authority.

**Coordinated Planning with Other Concerned Agencies**

A number of other federal and state agencies have important missions and jurisdiction that are directly affected by the FCC's actions (see Appendix 5). These include: Department of State, Department of Commerce, NASA, DOD, FAA, NOAA, Department of Transportation, as well as specialized federally-funded think tanks such as the Institute for Defense Analysis (IDA), which in a recent Forum in October 2020 expressed concern about the satellite collision risks. NASA has formally commented and issued a clear warning.

The FCC does not appear to have consulted closely with any of these agencies, much less other governments or international organizations in developing effective regulations for satellite applicants to mitigate collision, debris, or meteor risks.

**Proposed New FCC Rules**

The new FCC Rules must require:

- Satellite constellation applicants to sign an indemnification agreement and provide proof of adequate insurance to cover collision risks and accidents resulting from space debris and other potential hazards noted in this Section.
- Pursuant to Amendment 2, Rule 19-81A1 applicants must post immediately and without exception a) a surety bond; 2) at significantly higher levels to reflect the risks; 3) the beneficiaries of the bond must be specified.
- Require a detailed Plan specifying the detailed measures an applicant must implement to mitigate these risks
- Licensees provide the FCC and other concerned agencies with real time data to assist these agencies in developing more effective policies and programs for accident prevention and mitigation.

- Tangible evidence that the applicant has invested significantly in developing innovations in the area of satellite safety and accident prevention.

**Important Policy Questions**

- What advanced technologies must the FCC and other U.S. agencies require satellite companies to deploy in mitigating the risks of collisions and accidents from debris, meteors, and other hazards?
- What process will elicit the best scientific and engineering expertise within the U.S. government, Congress, and the international community to address the challenges of accidents involving low orbit non-stationary satellites?
- Why is the international public being asked to shoulder these risks and costs of uninsured unproven, untested, early stage technologies, whose public benefits are at present entirely speculative, especially contrasted with viable proven alternatives?
- Given the politically volatile theatre of commercial and military competition in Outer Space, how might a major collision in Space, even an accidental one, cause a spiral of recriminations and misunderstandings, triggering a Space War?

**<u>Proposal #3: Cybersecurity.</u> The FCC's satellite permissive licensing program is currently violating various laws, policies, and regulations safeguarding Cybersecurity and jeopardizing national and international security. The FCC must condition new licenses based on Cybersecurity sign-off from other agencies with proper jurisdiction and domain expertise. The FCC must require applicants to comply with GDPR as a condition of satellite licenses.**

This Petition addresses two classes of Cybersecurity Risks: 1) Loss of operational control, and 2) Invasion of privacy and theft of intellectual property (IP).

**Cyber Security Risk #1**[11] **— Loss of Operational Control**

Space has become the new Cybersecurity Frontier. When Cybersecurity is compromised, as it already has been, all other risk domains intensify, and the probability of a Compounding System-wide Negative Resilience Multiplier dramatically increases.[12] Without any comprehensive interagency risk assessment, the U.S. government, indeed the entire international community, is essentially flying blind.

The ambitious plans of privately held companies to launch thousands of satellites highlights the critical danger that there are no Cybersecurity standards and regulations for commercial satellites. Currently, commercial satellites have not been made a national security priority. (President Trump's Space Directive SPD-5 offers a framework, but does not provide standards.) Nor was Space included by the Trump White House in addition to 16 sectors deemed essential for National Strategic Economic Infrastructure. Notwithstanding, communications systems, defense systems, weather forecasting, financial transactions, environment forecasting, transportations systems, GPS, that all increasingly depend on infrastructure in Space and on the ground.

Moreover, the US military and civilian government's growing dependency on commercial satellites is exacerbating the problem. Currently, the FCC has no standards or regulations for cybersecurity risk assessments and controls on blanket licenses for satellites, base and earth stations, elevation modifications and other activities.

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[11] For an excellent introduction to cybersecurity risk, see 60 Minutes: SolarWinds: How Russian spies hacked the Justice, State, Treasury, Energy and Commerce Departments.

[12] For an in-depth discussion, see Julian Gresser, "Integral Resilience-Helping Communities Thrive" at http://www.resiliencemultiplier.com. We can expect that when Cybersecurity is compromised, secondary and tertiary cascading effects will ensue, which seriously impair the resilience of tightly coupled systems, as inevitably occur in terrestrial catastrophes. Strong support for the proposition that Outer Space presents especially serious challenges for Cybersecurity can be found in the White House's Space Policy Directive-5.

- There are no diversified or hybrid architectures that demand Cybersecurity best practices.
- The satellite market is transitioning away from a government community that is small and well trained, and moving to "Space for everyone."
- Adding to the lack of Cybersecurity architecture and standards is the overlay of satellites' complex supply chain, which include many foreign players that present additional security risks. There exist no guidelines for the complicated layers and integration of companies and component parts, all of which leave these satellites vulnerable to cyberattacks.
- The number of small satellites will increase with the growth and demand for 5G and future generations.

**Why Space is the Next Cybersecurity Frontier**

- Increasing numbers of satellites increase entry points to attack.
- Cybersecurity is an afterthought in the commercial rush to market.
- Antiquated I.T. equipment is more vulnerable to attack.
- Currently, in space cyber-security protocols are less rigorous than other industries.

**Attack Scenarios**

- Hackers can take control of satellites, shutting down, denying access to services, jamming, or spoofing systems. Further, satellites can be speeded up, slowed down or changed in direction. If hackers take control, they can change the orbit and create havoc to the satellite and satellite constellations, potentially rendering certain orbits, and all of space, inaccessible for future explorations.

- Jamming and control takeover technology is readily available and inexpensive, and the benefits to hackers (state or non-state) are growing.
- The speed of innovations in cyber-threats is faster than the space industry can keep up.
- Smaller satellites use many components with open-source technology enabling back-doors for hackers to exploit vulnerabilities.
- Hackers can gain control of ground stations which run computer software that can be exploited to send malicious commands to satellites.
- More satellites in orbit create a larger attack surface for hackers, and require more ground facilities to secure.
- Inconsistent software patching, weak or no encryption, legacy IT or OT (operational technology) equipment are all areas of enhanced vulnerability.

**Further Concerns from Experts**

- The "common knowledge" within the U.S. government rests on the fallacious assumption that because Cybersecurity systems are encrypted, they are secure. This is a dangerous and fundamental error.
- Terrestrial systems (base and earth stations) that control communications with satellites are most vulnerable, and often based on old and obsolete software systems.
- It is possible for hackers to seize operational control of individual satellites and constellations of satellites within hours, if not minutes.
- In 2017 a Russian NotPetya malware penetrated the Danish shipping company Maersk's servers causing $200-$300 billion in damages in a matter of weeks. The outage left Maersk unable to process shipping orders until systems were restored, freezing revenue from several of the company's shipping container lines for weeks. Just by chance, a

server in Ghana had been shut down prior to the attack, which enabled Maersk engineers to restore the system. Otherwise, the damage might have been far greater and possibly irreversible. Although the Maersk case involved a terrestrial attack, it points to the vulnerability of base stations which are a critical part of the satellite infrastructure.

- There are likely many more classified cases of attempted or successful hacking.

**Who Pays/Who Benefits?**

Unlike collision dangers or health and environmental risks, Cybersecurity risk insurance is available, although it likely will not adequately cover the level of damages, such as a cascading event along the lines of the Maersk attack which cost the company $300 million in a month. Cybersecurity is one of those rare areas where diverse interests — the satellite industry, environmental and consumer groups, and the government — all align. Given the astronomic costs of an effective cyber-attack, SpaceX, Kuiper and others have as much interest in a protective Cybersecurity regulatory regime as the general public.

**Present Rules and Their Defects**

The FCC has failed to date to promulgate new rules addressing satellite Cybersecurity risks. The absence of FCC Rules is triggering interagency conflict, as indicated by the continuing controversy between the FCC, DOD, and DOT over the Ligado case, and the FAA's repeated expressions of concern over aircraft interference, in both instances creating promising targets for cyber-assaults. (See here for the FAA's statement.)

**Applicable Laws**

The specific legal framework addressing Cybersecurity risks of satellite launches and constellation operations is contained in the December 2020 Memorandum on the National Space Policy Directive-5. Section 2.1 states:

> It is the shared interest of all nations to act responsibly in space to ensure the safety, stability, security, and long-term sustainability of space activities. Responsible space actors operate with openness, transparency, and predictability to maintain the benefits of space for all humanity.

The Memorandum on the National Space Policy draws upon the earlier Solarium Commission Report led by Representatives Angus King and Mike Gallagher. The Solarium Commission produced 80 recommendations, many of which are directly pertinent to new Rules the FCC must consider in approving blanket licenses for new satellite launches and operations. In March 2020, the Solarium Commission called for agile and rapid implementation of its proposals. The third important legislative and policy foundation for a comprehensive and integrated Cybersecurity policy is the Secure 5G and Beyond Act of 2020. Of particular relevance is Section 3 calling for the preparation of an interagency Strategy Implementation Plan within 90 days beginning March 2020. An important subsection (2) states:

> An identification and assessment of potential security threats and vulnerabilities to the infrastructure, equipment, systems, software, and virtualized networks that support 5th and future generations wireless communications systems, infrastructure, and enabling technologies. The assessment shall, as practicable, include a comprehensive evaluation of the full range of threats to, and unique security challenges posed by, 5th and future generations wireless communications systems and infrastructure, as well as steps that public and private sector entities can take to mitigate those threats.

Pursuant to the Secure 5G and Beyond Act, the government released on January 6, 2021 a National Strategy to Secure 5G Implementation Plan (Plan). As of this writing, it does not appear that the Plan, the Solarium Report or Space Policy Directives have caused the FCC to incorporate these clear policy directives as yet into specific new Rules. An important overall objective of this Petition is to require satellite applicants to address urgent national and international security risks, as identified in the Plan, as a condition of their applications.

**Coordinated Planning with Other Concerned Agencies**

The FCC has failed to consult carefully, as required by the above laws and policies with the following agencies that have domain expertise, jurisdiction, or strong policy concerns regarding Cybersecurity: Department of Homeland Security, Cybersecurity Infrastructure Agency (CISA), DOD, FAA, NIST, DOC, and other agencies identified in Space Policy Directive 5 September 2020, as well as the Congressional Cybersecurity Caucus and several Congressional Oversight Committees.[13] As set forth below, the FCC must adopt NIST Cybersecurity Framework and implement physical and cyber controls based on close coordination with and guidance from agencies and committees with expertise in Cybersecurity.[14]

**Solarwinds Cyber-Attack**

All of the above concerns are deepened by the discovery of alleged Russian hacking of Solarwinds which apparently began in March 2020 or perhaps even earlier. The Cybersecurity and Infrastructure Security Agency announced in December 2020 that the threat "poses a grave risk to the federal government... state, local, and territorial governments as well as critical infrastructure entities and other private sector organizations." The extensive damages from this cyber-attack are still being assessed[15] and the success of damage mitigation is not easily determined. Even as this Petition is filed a new cyberattack from China against Microsoft is

[13] United States Senate Commerce Subcommittee on Communications, Technology, Innovation and the Internet; United States House Committee on Energy and Commerce

[14] Even as this Petition is filed, a new cyberattack from China against Microsoft was reported, causing CISA to issue a new Emergency Directive: Mitigate Microsoft Exchange On-Premises Product Vulnerabilities. The federal government has already launched a cybersecurity coordinating group on the Solarwinds attack, and this very week is reported to be organizing a similar group on the Microsoft attack. The entire field requires interagency coordinated attention.

[15] Congressional bi-partisan recognition of increasing the oversight role of CISA is increasing. See Massive breach fuels calls for US action on cybersecurity.

reported, causing CISA to issue a new Emergency Alert to Mitigate Microsoft Exchange On-Premises Product Vulnerabilities.[16]

**Proposed New Rules**

- The FCC and applicants must obtain sign off from all concerned Cybersecurity agencies, beginning with the Administrator of the Cybersecurity and Infrastructure Security Agency (CISA), noted above for new satellite and earth station licenses, at least until a comprehensive framework addressing Cybersecurity risks is in place.
- Applicants must contract with the FCC to provide indemnification to the U.S. government and private parties, and present proof of adequate insurance coverage with a broad clause designating third party beneficiaries of such insurance.
- Applicants must present a Cybersecurity Mitigation Plan identifying the risks noted in the December 2020 Space Directive and Solarium Report and effective steps to control and to mitigate them.
- When available, applicants must certify compliance with all new Rules developed through the interagency consultative process required by the Secure 5G and Beyond Act and various Space Satellite Policy Directives.

**Important Policy Questions**

- By what legal authority can the FCC ignore and derogate the mission and jurisdiction of other concerned federal agencies with deep domain expertise in Cybersecurity?
- What other agencies will be held responsible if a major security catastrophe occurs by actions of the FCC in total disregard of established Cybersecurity warnings?

[16] In 2015, China and Russia signed a Cybersecurity Non-Aggression Pact. See War on the Rocks Peering into the Future of Sino-Russian Cyber Security Cooperation.

- What steps must the FCC immediately adopt, including effective consultation with other agencies with domain expertise?
- What new Rules do these concerned agencies propose that the FCC must follow in addressing Cybersecurity risks and their cascading international impacts?

**Cybersecurity Risk # 2 — Compromise of Personal and Organizational Privacy and Jeopardy of Intellectual Property.**

**General**

Systemic compromise of personal privacy around the world from governmental and corporate surveillance is essential to the Satellite Experiment. A recent article in MIT's Technology Review starkly expresses the trend, "Soon, satellites will be able to watch you, everywhere all the time." Invasion of privacy and appropriation of data by use of satellites is closely linked with compromise of intellectual property.[17]

At present the MIT article estimates 768 commercial space "observation satellites" are in orbit, and the innovative capability of private companies, hackers, and terrorists to deploy this surveillance capability at a resolution of 25 centimeters for private gain vastly outstrips the capacity of governments to regulate it. (Military satellites can capture images at far greater granularity, a capability which is classified, and outside the scope of this Petition). It is highly likely that some companies have already, or will soon start illegally deploying high resolution data analytics to intensify surveillance. It is estimated that surveillance satellites are monitoring major cities around the world approximately 70 times per day. Unlike cell phones that we can at least leave at home, satellites remove informed consent entirely, continuously prying into

[17] See https://www.trtcle.com/online-cle/ca/316/privacy-cybersecurity-and-intellectual-property

people's movements, scrutinizing the stores we patronize, where our children go to school, and our most personal behavioral patterns, entirely without our consent.[18]

The risks to businesses from theft of intellectual property by satellites parallel those of invasion of personal privacy. In this regard China's Space Program which closely integrates military, commercial, and industrial policy goals presents a special challenge. The FCC continues to ignore the satellite/IP challenge, and like its similar apparent disregard for export controls discussed below, there are no rules to protect strategic IP holders from IP theft from satellite hacking. As providers of a key instrumentality, satellite companies arguably have responsibility to disclose, warn, safeguard, and mitigate the risks to IP owners.

**National Regulations to Protect Privacy**

The gold standard for privacy protection is the EU General Data Protection Regulation (GDPR), which governs how personal data of individuals in the EU may be processed and transferred. The GDPR went into effect on May 25, 2018. It is a comprehensive privacy legislation that applies across sectors and to companies of all sizes. It imposes penalties in millions of euros and percentages of revenues based on global operations. Various states such as California have modeled their privacy protection laws upon the GDPR standard. For example, the California Consumer Privacy Act of 2018 (CCPA) gives consumers more control over the personal information that businesses collect about them, and includes the right to delete personal information collected from them (with some exceptions), the right to opt-out of the sale of their personal information,[19] and other protection.

[18] See Soon, satellites will be able to watch you everywhere all the time | Technology Review.
[19] See Privacy, Free Expression, and Government Surveillance in a New World of 5G/AI/Internet of Things (with Attorney Lawrence Walters).

**Legal Questions**

There is a serious legal question of whether the FCC's blanket licenses to commercial satellite companies, which are using and selling private information without the informed consent of consumers for private commercial gain, is a violation of the GDPR, California state law, and the laws of many other countries around the world. If the FCC is the lead agency that is permitting such putatively illegal activity, must it not adopt new Rules to require that commercial satellite companies create basic protocols to protect consumers? The breakdown of Cybersecurity only increases this immediate and additional risk.

In addition to national privacy protection laws, privacy is a fundamental human right recognized in the UN Declaration of Human Rights, the International Covenant on Civil and Political Rights and in many other international and regional treaties. Privacy underpins human dignity and other key values such as freedom of association and freedom of speech. It has become one of the most important human rights issues of the modern age. Article 12 of the Universal Declaration of Human Rights provides that "no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation." The FCC's piecemeal willy-nilly blanket permissions to satellite companies without any consideration whatsoever of constraints on the uses of surveillance data is in direct violation of this body of international law and precedents.

**Proposed New FCC Rules**

- The FCC should adopt the GDPR as a practical starting point. All future satellite applicants shall be required to prepare a CyberSecurity Privacy Protection Plan that ensures full compliance with the GDPR standard. The Plan includes regular reporting obligations on the status of compliance, and a commitment to use best available

Cybersecurity measures, technologies, and protocols, and to upgrade continuously. Failure to maintain Cybersecurity privacy protections responsibly shall result in immediate revocation of the FCC license, and full public disclosure by the applicant. The FCC reserves the right to require a bond, indemnification, and insurance to compensate victims of data privacy abuses.

**Proposal #4: Environment and Health. The National Environmental Policy Act (NEPA), international Environmental Treaties and Conventions, and International Customary Law require the FCC to carefully assess the environmental and health impacts of the Satellite Experiment in the U.S., on other countries, and the international environment, based on close consultations with all concerned federal, state, tribal and international agencies and organizations. The FCC must adopt new Rules that accurately reflect these assessments.**

**Essential Security Challenge**

The blanket licensing by the FCC's International Bureau of 80,000+ satellites and millions of earth stations presents immediate and increasingly profound environmental and health risks to every living person on earth and the entire planetary ecosystem, none of which have been addressed in the FCC's licensing program. This section catalogues and prioritizes these risks with supporting scientific references. It proposes a process of consultation and decision making that the FCC can adopt, reflected in new Rules, based on an interagency process to evaluate these risks.

- **Impacts on Trees, insects, bees, birds, and other wildlife.** There is increasing scientific evidence that non-ionizing radiation and power transmissions are causing immediate harm to plants and animals and biological processes. For example, we have increasing evidence of the adverse impacts on bee populations. Although the direct

causal connection with satellites is as yet undetermined, the available evidence creates a *prima facie* case that, at the very least, this risk ought to be carefully evaluated. Serious concerns have also been raised about interference with bird navigation systems and migratory capabilities. Attorney Joe Sandri, Board Member of the Archangel Ancient Tree Foundation in previous filings to the FCC has pointed out that trees act as biological transceivers (also see here), much like other non-living communications systems; and this unique part of our planet's ecosystem is likely being now disrupted, and will be endangered by the proliferation of satellites and earth stations. Given the critical importance of bees and insects to crop propagation, the adverse impacts on plants and animals can have immediate cascading effects on other national security domains, such agriculture production and food security. We have no evidence that the FCC has consulted at any depth with the Department of Agriculture to assess these impacts. There is no evidence that the FCC has consulted with the United Nations Environmental Program or any of the other international organizations concerned with rapidly declining biodiversity.

- **Weather forecasting**. There is growing concern that weather patterns can jeopardize the operations of satellites, and the proliferation of satellites can interfere with weather forecasting and assessments. The World Meteorological Organization (WMO) is concerned that the uncontrolled 5G+ satellite infrastructure will degrade weather forecasting capabilities worldwide. Specifically:

> "The 5G transmissions will involve many frequencies, but the key one under discussion is 23.8 gigahertz. Water vapour in the atmosphere naturally produces a weak signal at this frequency, which satellites use to measure humidity. Those data feed into weather forecasts. But if a 5G station is transmitting a signal near the 23.8-gigahertz frequency, a weather satellite might pick it up and interpret it as water vapour. And that bad data could degrade forecasts."

- Again, we have no evidence that the FCC has consulted closely with the WMO, NOAA, NASA, DOA, or the EPA to name only a few international and national organizations in reaching the conclusion that the impact of satellites on weather forecasting is too trivial to justify serious consideration.

**Human Health Impacts**

The FCC is permitting the encapsulation of the entire planet in a wireless matrix (see Figure #3).

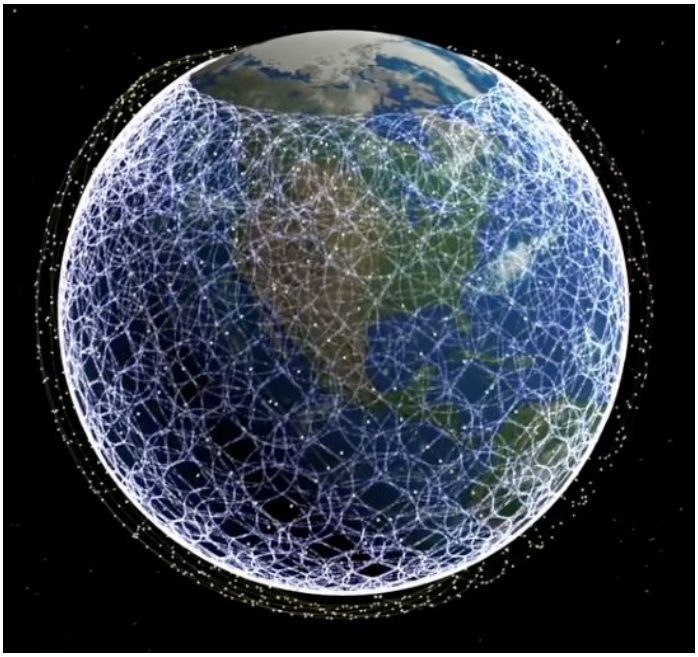

Figure #3

The possible health effects of 5G/RFR/Magnetic field exposures from satellites can be distinguished in two categories: direct harms from satellite radiation on human populations, and harms emanating from the reception and transmission of millions of base and earth stations

which are the foundation of satellite communications. To date, the FCC has declined to assess either form of risk as requested in Petitioner's March 2020 Application for Review. With regard to base and earth stations, the FCC does require applicants to submit a Radiation Hazard Report (RHR).[20] However, this present regulation (see below) does not require an assessment of aggregate or cumulative harmful effects, nor effects on neighbors who may not have provided informed consent. As plainly set forth in the Declaration of electrical engineer Ben Levi in the Application for Review, applicant SpaceX did not even bother to sign the RHR for its CP Terminal ground station, and it is unclear how the company derived the numbers to support its claim that the maximum exposure was within acceptable FCC regulations.[21] The FCC persists in discounting cumulative impacts of RFR from millions of base and earth stations as trivial. It is unclear whether the inadequate RHR filed by SpaceX and challenged by Petitioners in March 2020 was an isolated example, or whether the indifferent treatment by the FCC's International Bureau to the patent defects in SpaceX's RHR reflects the FCC's policy and common practice.[22] Starlink is now rapidly moving into the U.K. and Australia.[23]

**No Effective FCC Science-Based Health Standard**

The FCC currently does not have a science-based health standard for 5G/RFR/ELF/ Magnetic Field exposure. The FCC's present thermal standard recognizes penetration of the skin of those exposed to RFR.[24] There is no provision for aggregate, cumulative, or synergistic effects. There is no mechanism to secure the informed consent of those who are exposed;

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[20] Federal Communications Commission Application for Satellite Space and Earth Station Authorization

[21] FCC - Human Exposure to Radiofrequency Electromagnetic Fields April 6, 2020.

[22] Amazon has just announced a new flat panel customer terminal for its Kuiper satellite constellation. There does not appear to be an RHR in place as a condition of its use.

[23] See SpaceX Starlink beta arrives in the UK, sets sights on rest of Europe and Australia.

[24] See Carpenter et al., Thermal and non-thermal health effects of low intensity non-ionizing radiation (2018); also WHO | ELF Electromagnetic fields and public health (2007).

certainly there is no standard whatsoever in terms of harmful effects on plants and animals. The FCC standard is currently being challenged in Environmental Health Trust/Children's Health Defense v. FCC.

**Magnetic Fields**

An additional problematic area relating to base and earth stations is the adverse health effects from cumulative exposure to low level radiation from magnetic fields. The present WHO standard is expressed as follows:

> "This classification was based on pooled analyses of epidemiological studies demonstrating a consistent pattern of a two-fold increase in childhood leukemia associated with average exposure to residential power-frequency magnetic field above 0.3 to 0.4 μT. The Task Group concluded that additional studies since then do not alter the status of this classification.
>
> However, the epidemiological evidence is weakened by methodological problems, such as potential selection bias. In addition, there are no accepted biophysical mechanisms that would suggest that low-level exposures are involved in cancer development. Thus, if there were any effects from exposures to these low-level fields, it would have to be through a biological mechanism that is as yet unknown. Additionally, animal studies have been largely negative. Thus, on balance, the evidence related to childhood leukemia is not strong enough to be considered causal."

However, the key challenge for the FCC is not causation, but rather the burden of proof relating to prevention. There is ample scientific evidence of potential harm, supporting the WHO's finding that a lower evidentiary standard of prevention, heightened vigilance, and precaution, wherein the burden of proof shifts to the applicant, is appropriate. This administrative practice of shifting the burden of proof is not unusual in administrative practice involving other federal agencies (for example in cases of employment discrimination). (See generally: Devra Davis, "The Shotgun Wedding of Science and Law: Risk Assessment and Judicial Review, 1985.)

An additional problematic area relating to base and earth stations is the adverse health effects from cumulative exposure to low level radiation from magnetic fields associated with power transmission.

**Chemical Trails**

Various commentators[25] and concerned groups have pointed out to the FCC the hazards of satellites' utilizing toxic fuel propellants such as mercury and other hazardous substances. See, for example, November 19, 2018 letter from Kevin Bell, staff counsel at Public Employees for Environmental Responsibility to Marlene H. Dorich, Secretary, Federal Communications Commission; also Elana Freeland's book, *Chemtrails, HAARP, and Full Spectrum Dominance of Planet Earth* (Feral House, 2014).

**Plutonium Transport**

Elon Musk has apparently seriously advanced a proposal[26] to transport plutonium on SpaceX Starships with the intention of exploding nuclear weapons over Mars to extract its water, minerals, and render the planet suitable for human habitation.[27] The FCC's current regulations do not appear to require public disclosure by applicants of the contents of the fuel or payload, including the presence of mercury, plutonium, or other hazardous or explosive materials.[28] At the same time NASA and the UN Office of Outer Space Affairs (UNOOSA)

[25] See Martin N. Ross and Leonard David, Space Pollution, Scientific American February 2021.
[26] The FCC does not appear to be requiring public disclosure from applicants of the contents of the payload or fuel. Actually, the FCC may not have a clue what Musk is carrying on board his satellites. See, e.g. Nukes in space: Elon Musk's push for nuclear propulsion, Looks Like Elon Musk Is Serious About Nuking Mars; Elon Musk Plans to Drop Nuclear Bomb Above Mars to Make it Habitable; Elon Musk's SpaceX Starship explodes during testing.
[27] From Space Policy Directive 6: "Section 1. Policy. The ability to use space nuclear power and propulsion (SNPP) systems safely, securely, and sustainably is vital to maintaining and advancing United States dominance and strategic leadership in space." Can the transport of plutonium on rockets be done safely and securely, in light of present unaddressed Cybersecurity risks?
[28] Concern about nuclear accidents in space is not poor science fiction. On 24 January 1978 a dead Russian COSMOS 954 satellite crashed in the Canadian Northwest Territories, scattering

signed on December 17, 2020 a Memorandum of Understanding to ensure the peaceful uses of Outer Space.

**Light Pollution**[29]

As Figure #4 depicts, satellites will adversely illumine and adversely transform the night sky forever.

Figure #4

**Protests** against light pollution are taking place around the world and the petitions are ongoing. Light pollution not only offends aesthetic sensibilities. It is of direct concern to astronomers whose very livelihood is now being threatened and multi-million dollar research contracts being impaired. The plea of astronomers is poignantly expressed in the Charter of the "Saving the Astronomical Skies Foundation", written by Dr. Stefano Gallozzi, manager at the INAF Osservatorio Astronomico di Roma in Italy. For astronomers around the world, the light

radioactive debris over a 600 km footprint and spreading radioactivity over 100,000 km$^2$. The clean-up operation, called "Operation Morning Light," jointly coordinated by Canada and the US, recovered 80 radioactive items. The COSMOS 954 crash became a prototype for global emergency preparedness and response arrangements for satellites carrying nuclear power sources. See Ensuring Safety on Earth from Nuclear Sources in Space.

[29] See U.N. General Assembly Committee on Peaceful Uses of Outer Space — Recommendations to Keep Dark and Quiet Skies for Science and Society.

pollution of the night skies is an emergency. Their very livelihood is immediately being threatened. The FCC is cavalierly ignoring the ardent appeals of astronomers such as Dr. Gallozzi, and his newly formed organization, *Safeguarding the Astronomical Sky Foundation*, which is a Petitioner in this case, in favor of the economic interests of satellite companies, without any attempt to assess and balance the concerns of the parties. (See this link for pictures of what the astronomers see.)

**The Square Kilometer Array (SKA) Observatory Convention and Risks from Satellite Constellations.** The SKA project is an international effort to build the world's largest radio telescope, with eventually over a square kilometer (one million square meters) of collecting area. The scale of the SKA represents a significant advance in engineering, research and development towards building and delivering a unique instrument, with the detailed design and preparation now well under way. As one of the largest scientific endeavors in history, the SKA will engage the world's finest scientists, engineers and policy makers. Eleven countries have signed the SKA Convention which establishes the Collaborative SKA Observatory (SKAO) with Global Headquarters of the Project in London.

In October 2020 the SKA Administration conducted a study on the adverse impacts of satellite constellations on SKA research and capabilities and means to mitigate them. The study focuses on the impact of the deployment of the principal currently planned space-based systems, totalling 6,400 satellites, on the SKA-Mid telescope soon to be erected in South Africa, which will consist of an array of 197 dishes. The SKA Study's findings are stark and clear:

- Without specific mitigation actions by the constellation operators, there is likely to be an impact on all astronomical observations in Band 5b.

- This impact includes a loss of sensitivity in the frequency range used by the constellations, leading to astronomical observations in that range taking 70% longer.
- The science impact is most significant for studies of molecular and atomic spectral lines in that range, including complex organic molecules; Class II methanol masers; and a wide range of extragalactic molecular lines.
- Viable mitigation techniques identified by SKAO can reduce this impact on SKA-Mid by a factor of 10, if implemented by relevant satellite operators.
- For significantly larger constellations, of up to 100,000 satellites, the effect on the SKA would be much worse, potentially threatening the viability of the complete Band 5b for 100% of the time, unless stringent mitigation actions are put in place.

Note #2 continues:

> Satellite manufacturers are bound by international agreements under the ITU, which guarantee radio astronomy protected bands, including that at 10.6-10.7 GHz, are not affected by their transmissions if strict control is exercised over the spill over from one band to another – a perennial problem with other satellite operators.
>
> However, the field of radio astronomy has developed tremendously since and new scientific knowledge has required radio astronomers to expand their observations beyond the traditionally protected bands. **The majority of SKA's Band 5b – and indeed of all of the SKA bands – is therefore not protected by ITU regulations.** (emphasis added)

Note #3 states:

> Recent filings to the FCC have revealed operators' plans to increase the mega-constellation size to tens of thousands of satellites. **This dramatic increase in numbers would mean that, if left unmitigated, the effect of these constellations on the SKA would be much worse than predicted above, potentially threatening the viability of the complete Band 5b for 100% of the time. This would require further action and more stringent mitigation in order to protect the SKA.** (emphasis added)

The SKA Study details specific mitigation measures that will address some of these risks, including reducing the power, deflecting and redirecting beams, and other strategies.

In a public statement, SpaceX founder Elon Musk dismissed the Study observing that Starklink's constellations will have a "0% effect on advancements in astronomy." In short, the precautions called for by the SKA Administration are unnecessary. (See Proposed New Rules.)

**Satellite Base and Earth Stations' Impact on the National Parks, Historical, and Cultural Sites**

The FCC's blanket licensing of satellite base stations and earth stations, along with other cell towers in the national parks and around historic sites, including Indian lands, raises profound issues under NEPA (discussed below), the National Historic Preservation Act, and various state environmental protection laws, as cell towers present a recognized fire hazard that is not easily abated. In his magisterial work, The National Parks — America's Best Idea, Ken Burns poignantly accounts the historical conflict between rapacious mining and other interests and those who have sought to protect America's national park treasures. The FCC's permission of cell towers and satellite earth stations in the national parks must rank among America's Worst Ideas.

On January 8, 2021 the General Assembly of the United Nations issued detailed Recommendations to Keep Dark and Quiet Skies for Science and Society.

**Rainforests**

There is substantial scientific evidence confirming the rapidly accelerating deterioration of the world's rainforests. Although satellite images are currently being used to assess rainforest vulnerability, there is no reason to allow the pell-mell licensing of over 80,000 satellites and millions of base and earth stations to enable this one useful application. In fact, many of the

unaddressed environmental risks noted in Section IV compound when we realize how near rainforests and their vulnerable animal and plant species are to a tipping point. As explained in the accompanying Declaration of Sally Jewell Coxe, Founder and President of the Bonobo Conservation Initiative, even a 1% yearly deterioration over the next ten years can have devastating consequences.

- **Toxic waste pollution.** This is an area of increasing scientific concern. If developing countries start locating thousands of EMF emitting base and earth stations in rainforests, as the FCC is currently allowing in national parks in the U.S., the results can be devastating.
- **Ozone layer.** One important study emphasizes the complexity of this connection with rainforests and the need for far deeper assessments.
- **Light Pollution** may be particularly injurious to nocturnal plants and animals in rainforests that depend on darkness for their survival.
- **Endangered species/biodiversity.** The rainforests are the last preserve of many endangered species, such as the bonobos. Bonobos are classified as Endangered on the Red List of Threatened Species (IUCN 2012), and are listed on Appendix I of the Convention for International Trade in Endangered Species.
- Carbon Credit Market. An annual 1% decline over ten years in the value of carbon sequestration can have a devastating effect not only on the Carbon Trading Markets and Exchange but also on economically disadvantaged countries like the Congo that depend upon this unique source of revenues.

The FCC and the satellite companies are brushing aside any rigorous consideration of these risks without any scientific foundation for this conclusion.

**Climate Change Risks**

When solid-fuel rockets launch, they release chlorine gas[30] directly into the stratosphere, where the chlorine reacts with oxygen to form ozone-destroying chlorine oxides. Increased domestic and international space launches and the potential commercial space travel boom could mean that rockets will soon emerge as the worst offenders in terms of ozone depletion. Soot and aluminum oxide in rocket exhaust deplete upper-atmosphere ozone, which shields the Earth's surface from damaging ultraviolet rays. In 1987, an international agreement limited releases of chloro-flurocarbon chemicals, or CFC's, that led to ozone depletion. Rocket launches by 2050 could result in more ozone destruction than was ever caused by CFCs, according to co-author Darin Toohey of the University of Colorado in important research into this problem. (See list of publications, and also here.)

The FCC does not require any disclosure or planning by satellite companies receiving blanket licenses to address or to mitigate ozone depletion by discharged rocket fuel exhaust. As confirmed in the Vienna Convention for the Protection of the Ozone Layer of 1985, signed and ratified by the United States on August 27, 1986, ozone depletion is recognized by many scientists throughout the world as one the principal drivers of climate change.

France's High Council on Climate (HCC) has just issued a report confirming that 5G may well lead to a sharp increase in power consumption and greenhouse gas emissions.

[30] An Underappreciated Danger of the New Space Age: Global Air Pollution - Scientific American, Nov. 2020 ($)

**Applicable International and National Laws**

There is a substantial body of international law based on treaties, conventions, and custom, as well as federal law that is directly relevant to the environmental, health, and associated food security and other risks of the FCC's satellite program. Together all these laws mandate the FCC to proceed with highest vigilance and care. The agency must consult closely with, and rely on the expertise of, other concerned federal (and state) agencies and international organizations in assessing the overall environmental and cascading consequences of its present piecemeal satellite program; and it must explore and assess viable alternatives. Until such assessments are made, Petitioners contend the FCC must pause all further licensing of satellites and earth stations.

**International Recognition of the Public Trust in the Heavens**

Professor Hope Babcock's 2019 article in the Syracuse Law Review, The Public Trust Doctrine, Outer Space, and the Global Commons provides an excellent historical review of the treaties and international policy statements regarding the protection of the Public Trust in Outer Space. Article I of the Outer Space Treaty captures this principle perfectly:

> "The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind."

**Protection of the International Environment from Outer Space Activities**

Regarding the transport of plutonium by rockets, Article IV of the United Nations Treaties and Principles on Outer Space states:

> States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

Article 3.1(a) states: "States launching space objects with nuclear power sources on board shall endeavour to protect individuals, populations and the biosphere against radiological hazards." This provision addresses the risks of the FCC's approval of the rocket transport of materials like plutonium, which are core components for the construction of a nuclear weapon. To the extent that frequencies for communication are involved, the FCC has jurisdiction.[31]

There are several environmental treaties that also constrain the FCC's blanket licenses of 80,000+ satellites and millions of earth stations without effective consultation with other nations and concerned international organizations. The European Space Agency has produced one compendium, the United Nations Office of Space Affairs another. In addition to treaties signed and ratified by the U.S. and policy statements by the UN, other treaties are also directly relevant such as the World Heritage Convention which scholars have recognized is applicable to the natural environment including Outer Space. Article IV states:

> "Whilst fully respecting the sovereignty of the States on whose territory the cultural and natural heritage mentioned in Articles 1 and 2 is situated, and without prejudice to property right provided by national legislation, the States Parties to this Convention recognize that such heritage constitutes a world heritage for whose protection it is the duty of the international community as a whole to cooperate."

Another relevant treaty is the Migratory Bird Treaty which has been implemented by a special federal statute, the Migratory Bird Treaty Act of 1918. Reference has also been made above to the Treaty for the Protection of the Ozone Layer. These and other environmental

[31] See SpaceX Seeks FCC Approval to Fly Starship to 20 Km – Parabolic Arc.

protection treaties reflect years of concern and creative thought by the international community which is put to scorn by the FCC's Satellite Experiment.[32]

In addition to its treaty obligations, there is strong precedent under customary international law that the activities of the FCC initiated in the United States create liabilities for harms to the environment of other countries and against the Global Commons. Excellent examples are the Trail Smelter arbitration, the Stockholm Convention and the Rio Declaration.

**National Environmental Laws as Constraints on FCC Action**

**The National Environmental Policy Act (NEPA) of 1969**. In United Band of Keetoowah Cherokees in Oklahoma v. FCC, the DC Circuit Court of Appeals reaffirms at the outset NEPA's core mission and the administrative test to ensure compliance:

> "Congress enacted NEPA to 'encourage productive and enjoyable harmony between man and his environment and promote efforts which will prevent or eliminate damage to the environment, the biosphere and stimulate the health and welfare of man', among other purposes."

Stating the standard for review, the Court correctly held, "NEPA mandates a review process that does not dictate particular decisional outcomes, but merely prohibits uninformed - rather than unwise - agency action."

The FCC's Satellite Experiment is without doubt a major federal action,[33] as this term has been interpreted by numerous federal courts since the NEPA's enactment. As such, the FCC

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[32] The FCC's permissive policy on the health effects of base and earth stations is encouraging applicants to establish beachheads in other countries. SpaceX's Starlink has been secretly applying for earth stations/transmission approval in other countries, such as Australia, under the name "TIBRO" (Orbit spelled backwards), and as soon as they get approval, they change the company's name to "Starlink" (e.g. see here.)

[33] See: 40 CFR § 1508.18 Major Federal action. Includes actions with effects that may be major and which are potentially subject to Federal control and responsibility. (a) Actions include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies; new or revised agency rules, regulations, plans, policies, or procedures; and legislative proposals (§§ 1506.8, 1508.17). Also see The environmental impact of emissions from space launches: A comprehensive review.

is under an obligation to assess the environmental impacts noted above and other serious consequences of its actions, along with more environmentally protective cost-effective alternatives. Based on many precedents, the FCC cannot escape its responsibilities under NEPA by piecemeal efforts, and then turn around and self-servingly assert that these individual blanket licenses fail to meet the major federal agency test.[34, 35]

**NEPA's International and Transnational Applications**

A substantial body of law and practice has developed around NEPA's international and transnational applications. For example, federal agencies have recognized NEPA in preparing Environmental Impact Statements on major actions involving ocean dumping, regulations for double bottoms on oil tankers, negotiations involving the international regulation of aerosols in connection with the Ozone Prevention Treaty, and negotiations involving the U.S. State Department's and other agencies' negotiating positions for the Law of the Sea Conference. In every instance these impact assessments have been made by the lead agency based on careful consultation and engagements with other concerned federal and in some cases state agencies, as was the original intent of Congress in enacting NEPA in the first place.

An important transnational precedent is *Government of Manitoba v. Norton* which recognized NEPA's applications to a water reclamation project upon another country, in this case Canada. In the present Emergency Petition, the impacts far are far more profound, multi-faceted, irreversible, and planetary.

**Right to Health as a Fundamental International Human Right**

There is strong precedent and scholarly support for the proposition that a right to a safe, secure, and healthy environment is a fundamental, internationally recognized human right. The

[34] See Viasat Petition to FCC re SpaceX 2020-12-22.
[35] See Recent NEPA Cases 2018 by P.E. Hudson and Lucinda Low Swartz.

right to health is recognized as a human right in the 1966 International Covenant on Economic, Social and Cultural Rights. The right to health is relevant to all States: every State has ratified at least one international human rights treaty recognizing the right to health.

The WHO Constitution (1946) envisages "…the highest attainable standard of health as a fundamental right of every human being." (See: Human Rights and Health, and The Right to Health Fact Sheet).

Principle 1 in the Declaration produced by the 1972 Stockholm Conference on the Human Environment states:

> "Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations."

The FCC's arbitrary blanket licensing of 80,000+ satellites, and the consequent Space Race it is accelerating, arguably represents the most formidable challenge to planetary health in human history. If any course of conduct urgently requires the protections envisioned by a body of international treaties dating at least back to the 1961 International Covenant and the Stockholm Conference, the uncontrolled Space Race being unleashed and encouraged by the FCC is it.

**Rights of Nature**

In 2008, Ecuador became the first country in the world to codify the Rights of Nature into its Constitution. A few years later an Ecuador Provincial Court vindicated the Rights of Nature, recognizing that Nature and all living creatures themselves have legally protected and judicially enforceable rights to maintain their health and integrity, independent and separate from similar rights possessed by human beings. The Ecuador Court builds on earlier precedents

and seminal law review articles[36] and other analyses by leading law scholars dating from the 1970s. The FCC's blanket approval of 80,000+ satellites with virtually no protections, thereby sparking a Space Race, is directly jeopardizing these fundamental Rights of Nature.[37] (See Declaration of Sally Jewell Coxe, Bonobo Conservation Initiative; an important legal question is whether the rainforests themselves, including their populations of animals and plants, especially endangered species, have independent rights in themselves, separately from human beings. As stated, Ms. Coxe's Declaration contains a plea on their behalf as well.)

**Administrative Procedure Act: FCC's Categorical Exemption and Disclaimer of U.S. Liability**

The FCC's regulation on categorically excluded activities was initially promulgated in 1986 and updated in 2015. It applies to activities that are deemed "individually and cumulatively to have no significant effect on the human environment and are categorically excluded from environmental processing." (47 CFR § 1.1306) The FCC has continued to treat its entire satellite program as falling within the categorical exclusion.

The most recent precedent is: United Keetoowah Band of Cherokee Indians in Oklahoma, individually and on behalf of all other Native American Indian tribes and tribal organizations, et al., petitioners v. Federal Communications Commission and United States of America which successfully challenged the FCC's categorical exemption of small cell towers,

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[36] Should Trees Have Standing? Toward Legal Rights for Natural Objects (1972); Does the Climate Have Standing? (2008); Environmental Personhood (2017); John Vidal, Bolivia Enshrines Natural World's Rights with Equal Status for Mother Earth (2011); Ecuador Constitution Grants Rights to Nature (2008); See Abigail Hutchison, The Whanganui River as a Legal Person, Abigail Hutchinson (2014); Upholding the Mana of the Whanganui River (New Zealand, 2014); Laurence H. Tribe, Ways Not to Think About Plastic Trees: New Foundations for Environmental Law (1974).

[37] As of 2019, Rights of Nature laws exist at the local to national levels in 12 countries, including dozens of cities and counties across the United States, in the form of constitutional provisions, treaty agreements, statutes, local ordinances, and court decisions.

eliminating NEPA analysis of the impacts on tribal lands. The DC Circuit Court recognized the invalidity of the exemption as arbitrary and capricious under the Administrative Procedure Act and remanded to the District Court for further consideration. The Court established the test for setting aside an agency order. It is even more applicable to an entire program, such as the blanket licensing of 80,000+ satellites and millions of earth stations:

> "An agency action is arbitrary and capricious where the agency has 'entirely failed to consider an important aspect of the problem' or 'offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.'" (See: 5 U.S.C. § 706(2)(A))

As described by Ramon J. Ryan in an important recent law review article,[38] four seminal NEPA decisions will help to guide a reviewing court in striking down the FCC's categorical exemption as applied to the Satellite Experiment:

- In *Foundation on Economic Trends v. Heckler*, the court held that NEPA review is especially important when agency action involves new and expanding technology with unknown environmental impacts.
- In *Friends of the Earth, Inc. v. U.S. Army Corps of Engineers*, the court established the importance of an agency thoroughly evaluating the direct, indirect, and cumulative effects its actions will have on the environment, as well as avoiding conclusory findings of no environmental impact.
- In *Sierra Club v. Bosworth*, the court set aside an agency's categorical exclusion because it lacked specificity and thorough consideration.

[38] See: Ramon J. Ryan, The Fault in Our Stars: Challenging the FCC's Treatment of Commercial Satellites as Categorically Excluded Under the National Environmental Policy Act. Vanderbuilt Journal of ENT & TECH Law Vol: 22:4:923

- Finally, in *Brady Campaign to Prevent Gun Violence v. Salazar*, the court held that an agency is responsible for NEPA review of its actions if it is reasonably foreseeable that those actions could lead a third party to engage in activity that could significantly impact the environment.

All four judicial NEPA tests apply to the FCC's blanket licenses of 80,000+ satellites and millions of base and earth stations. In the satellite field, the panoply of risks and harms noted above are far graver than those addressed by the courts in these seminal cases.

Following similar reasoning, the FCC cannot categorically exempt itself from liability for environmental, health, and other harms simply by a wave of its administrative hand by the stunning disclaimer that it lacks statutory authority for the very actions it is permitting. It is a *per se* violation of the Administrative Procedure Act for a federal agency such as the FCC to reach such an arbitrary and capricious conclusion without establishing a record of its decision making, based on consultations with other federal agencies, and in some cases international organizations, along with timely and transparent public hearings.

**Viasat, Inc. Section 1.1307(c) Petition**

On December 22, 2020 the satellite company Viasat submitted its own Petition challenging under NEPA the Commission's previous permission to SpaceX to modify dramatic elevations for over 3,000 satellites. The arguments by Viasat, in many areas consistent with the major Proposals in this Emergency Rulemaking Petition, are significant because they are presented by a commercial satellite company advancing public interest responsibilities and concerns. The following are relevant points advanced in the Viasat Petition, which is hereby incorporated by reference in full, building upon an earlier Opposition filed by the BALANCE GROUP and the Healthy Heavens Trust on May 26, 2020 citing some of these same concerns.

- The satellite elevation modifications proposed by SpaceX represent a major federal action under NEPA, for the reasons advanced by Viasat, along with the host of other unexamined risks which the Commission has arbitrarily chosen to ignore in its piecemeal blanketing licensing program.
- The complete failure of the FCC to conduct a three prong NEPA test, as a result of its piecemeal and balkanizing approach: 1) To take a "hard look" at the Satellite Experiment as a major federal action. 2) To determine that it deserves a basic Environmental Assessment, or Negative Declaration. 3) To conduct, as is appropriate in this case, a full Environmental Impact Statement, including impacts on the ozone level, climate change, wide ranging health effects, and alternatives.
- The unexamined environmental hazards which include debris, impacts upon the ozone layer, health effects, especially in light of the new scientific studies and reports cited by Viasat that confirm that the harms are accelerating, cumulative, compounding, and irreversible.
- The economic costs to the country of space debris far exceed the estimated $153 billion of public benefits being delivered by the space industry. (Citing the kind of systemic risk analysis Petitioners are urging in other areas of the eight domains of national/ international security risk; *See Nodir Adilov, Economic Dynamics of Orbital Debris: Theory and Application* (2019).)

**Present FCC Rules and Their Defects**

The FCC's asserted categorical NEPA exemption is contained in 47 CFR § 1.1306. The exemption must be categorically eliminated, and new rules developed as required in the above cited cases requiring the FCC to consult with all other concerned agencies, other countries, and

international organizations in preparing full Environmental Impact Statements. As noted above, the FCC's current regulations do not appear to require public disclosure of the contents of satellite applicants payload or fuels.

**Other Agencies with Jurisdiction**

These are listed in Appendix 5.

**Other Applicable Agency Rules**

The most directly applicable example is NASA's Rules which Ryan Ramon recommends as a model for the FCC. NASA's regulations rest on the basic conclusion that the launch and deployment of satellites do have profound environmental consequences. (See 14 CFR § 1216.304 (2019); 47CFR § 1.306.) As previously noted, other federal agencies such as DOA, NOAA, Department of State have complied with NEPA's mandate, and collaborated with other agencies on major federal actions in which they are the lead agency, or where they play a significant role.

**Failure to Consult as a Violation of the Administrative Procedures Act (APA)**

The *United Keetoowah v. FCC* case makes clear that failure to consult closely with other concerned agencies in preparing a Programmatic Environmental Impact Statement is a violation of NEPA and also a violation of the APA.[39] In the present case, these necessary agencies include NASA, Department of Defense, Department of State, EPA, Department of Agriculture, Department of the Interior, and other agencies noted in Appendix 5. A government agency's duty to consult and the public's right to know is powerfully enshrined in the Aarhus Convention signed by 46 countries in Europe, which in its Article I states:

[39] An important early precedent is Scientists' Institute for Public Information, Inc., Appellant, v. Atomic Energy Commission et al, 481 F.2d 1079 (D.C. Cir. 1973). See also Final Guidance for Effective Use of Programmatic NEPA Review, A Notice by the Council on Environmental Quality on 12/23/2014.

> OBJECTIVE: In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.

Although the U.S. has declined to sign the Aarhus Convention, the principle of a government's legal duty to be informed and to forewarn, and the public's right to know about intentionally authorized, predictable environmental and health catastrophes, are so fundamental, that they rise to the level of international customary law.[40] These principles can find no greater example than the FCC's current policy to exempt any consideration of environmental effects in its blanket licensing program for 80,000+ satellites.

**Benefits and Costs of Proposed Regulatory Subsidy for Satellite/Wireless Industry**

By giving satellite company applicants a free pass on the environmental and health risks of their activities, the FCC is extending a massive regulatory subsidy worth trillions of dollars to the few satellite companies, at the expense and without the informed consent of the international public. This regulatory subsidy is on top of the billions of dollars of special public taxpayer subsidies in the form of awards and grants, and redirection of public monies originally allocated to optical fiber infrastructure, and ratepayer overcharges, as described in the next section.

**Proposed New Rules/Regulations**

- The FCC must withdraw its categorical exemption and promulgate new Rules and regulations based on close consultations with all other concerned agencies set forth in Appendix 5, other governments, and international organizations in preparing a Comprehensive Programmatic Environmental Impact Statement.

[40] See e.g. The Constitutional Right to Information, and the International Committee of the Red Cross Customary Law.

- The FCC must strengthen its own Radiation Hazard Report regulations,[41] including requiring signed reports under declaration of perjury, and imposing fraud penalties for misrepresentation.
- The FCC must require full disclosure of the contents of payloads and fuels that contain toxic, hazardous, or explosive materials, including mercury, aluminum, and plutonium, or computer software used, or deployable in the construction or deployment of nuclear weapons.
- The FCC must immediately require applicants to demonstrate proof of implementing the reasonable Mitigation Measures urged by the SKA Administration to prevent or to reduce significant harms to astronomical research identified in its October 2020 Risk Assessment.
- Applicants under penalty of perjury must certify full good faith compliance with the proposed FCC's Comprehensive Environmental Impact Statement, including all mitigation measures, offering tangible evidence and proof of said averred compliance.

**Important Policy Questions**

- When will a tipping point be reached; and what will be its consequences, when all the environmental threats noted above — now being permitted by the present FCC permissive licensing policy — combine, cumulatively and synergistically?
- How might we even begin to measure the costs to society of such an event that is, even today, highly foreseeable?
- What top 5-10 federal and state agencies must the FCC immediately engage with, whose environmental missions and jurisdictions are being infringed by the FCC's unilateral and arbitrary blanket licenses to a few satellite companies?

[41] See e.g. SpaceX to FCC - Starlink "CP terminal" Radiation Hazard Report.

- How well prepared is the FCC today for catastrophic environmental contingencies? What Emergency Plans are in place? What Plan does the U.S. government have in place to compensate the international community for these damages?
- How can the FCC best support the work of a new Presidential Task Force commissioned to produce an Emergency Plan within 180 days, and other measures recommended herein, following a similar mandate in the Secure 5G and Beyond Act of 2020?

**Proposal # 5: Wired Broadband. In meeting the Digital Divide Challenge, the FCC must support wherever feasible optical Fiber-To-The-Premises (FTTP) solutions that offer an immediate, safe, secure, energy efficient, environmentally protective, and job generating alternative to a satellite-based wireless infrastructure. The implementation of subsidies to satellite companies must be paused until the national and international security challenges of the Satellite Experiment are assessed, as required by international and federal law.**

**Essential Harms and Security Risks**

A fundamental principle of U.S. telecommunications industrial policy is technology neutrality. In other words, the FCC must deal neutrally and fairly with all technologies, rather than picking "winners" and "losers". In fact, the present FCC policy is the opposite. The auction of grants in the FCC's recent Rural Digital Opportunity Fund Auction[42] to expand broadband to over 10 million rural Americans does not appear to include any significant allocation of funds to FTTP, as opposed to pure wireless, or optical fiber backhaul to support wireless infrastructure.

[42] There are other similar programs such as that being implemented by the Department of Agriculture Federal Broadband Funding Programs.

The present FCC policy embodies the very worst aspects and defects of an arbitrary industrial policy that lacks the benefits of a disciplined, data-driven quantitative analysis.[43] The departure by the FCC from the Neutrality Principle in using taxpayer monies to subsidize blanket licenses for millions of earth stations to support 80,000+ non-geostationary low orbit satellites is arbitrary, biased, and capricious, and violates federal and international law (including international trade agreements governing subsidies.) The FCC's present policy and actions are dramatically accelerating the risks of collisions, debris, Cybersecurity, and environmental dangers described above.

**Who Benefits?/Who Pays?**

The beneficiaries of the present FCC non-neutral policies are clearly wireless purveyors and satellite companies that are currently receiving billions of dollars in taxpayer and ratepayer subsidies, as exemplified by the recent award of $886 million to SpaceX Corporation.[44] In these commercially-driven public auctions, local municipalities have little or no fair opportunity to participate or to prevail. This unregulated corporate giveaway parallels closely the illegal diversions of taxpayer funds and ratepayer overcharges that is currently being litigated in the

[43] For an analytic framework for a coherent industrial policy, see The Trigger Method: A Powerful Way to Assess the Leverage of Strategic Industries and Technologies in Economic Growth and Job Creation.

[44] The FCC Rural Digital Opportunity Fund (RDOF) winners reports "Space Exploration Technologies Corp. received over $885 million for *642,925 locations"*. In Starlink's network faces significant limitations, analysts find, financial analysts estimates that once Starlink is fully operational, with "up to 12,000 satellites" it will support *485,000 simultaneous users at 100 Mbps*. Note those are not equivalent; they reflect a 75% RDOF capacity rate. What happens when there's a major catastrophic event that ripples throughout the global internet, such that more than 75% of all RDOF Starlink subscribers access the internet at the same time, along with all the other Starlink customers? The Starlink network will slow to a crawl. This risk is significant, considering the satellites will be accessible anywhere, at any time. To put it another way, if there's ever a need for global internet connectivity at the same time, Starlink will quickly get overwhelmed. There are currently around 3,500 active satellites in operation today, with Starlilnk more than 1,000 of them. Now imagine *12,000 Starlink satellites,* four times the current total up there right now. All for a system that, when its users would need it most, will likely let them down.

*Irregulators v. FCC* case. The present unsupervised grants to telecom and wireless companies compound trillions of dollars in regulatory subsidies extended to the satellite and telecom companies by the present no-man's-land of lax and non-existent regulations.

**Optical Fiber — A Safe and Secure Unexamined Alternative**

In fact, there is an immediately available, safe, secure, stable, environmentally protective, energy efficient, massive job-generating alternative, one which taxpayers have already paid billions of dollars for during the past twenty years. It is Optical Fiber-to-the-Premises (FTTP) for the home and workplace. The seminal report is Dr. Timothy Shoechle's *Reinventing Wires*, which includes many case studies of communities like Chattanoga, Tennessee that have transformed optical fiber into an engine of economic growth. A reference to the present optical fiber installations in municipalities across the country can be found here. Optical fiber is already the foundation of the telecommunications backhaul in virtually all communities across the country. The next critical step in which the FCC can play a pivotal role[45] is to accelerate FTTP solutions.

The only conceivable public policy justification the FCC and the satellite companies can make for endangering the planet and saddling an unconsenting public with the trillions of dollars of uninsured risks is easier access to the Internet for underserved, largely rural communities in the U.S. This is clearly a legitimate and urgent concern. However, as Dr. Schoechle explains in *Reinventing Wires*, optical fiber wired technology today can deliver a far more stable, reliable, lower latency solution to most rural communities; and for rapidly developing countries where paved roads are not always present, optical fiber offers a new job-generating, economic growth

[45] See e.g. Backflip to the Home. The Australian government recently announced a backflip and is implementing a vigorous program to invest AU $1 billion into connecting and upgrading 700,000 businesses in fiber zones across Australia, and $3.5 billion for residential fiber, generating 25,000 new jobs.

opportunity with the added and crucial benefit of local control and ownership,[46] without the huge risk factors noted above with regard to satellites and wireless.

**Energy Consumption — Wireless vs. Wired**

FTTP addresses the inherent tensions U.S. policymakers face between the imperative to provide broadband service to rural and other remote communities, and the increased energy usage needed for wireless infrastructure, including the earth and base stations that are fundamental to the Satellite Experiment. Typical energy usage for a Starlink CP Terminal earth station is 100 watts, which for one million earth stations is approx. 875 Gigawatts/year. This inefficient solution would provide weather-dependent, less safe, speed-limited internet; compared with FTTP, which arguably is the most energy-efficient, future-proof, and fastest broadband available to rural and other remote communities. The impact of the Satellite Experiment on national and global energy consumption, and the nexus with climate change of massive, non-sustainable energy consumption required to complete the satellite network, in particular millions of base and earth stations, is clearly an impact that must be assessed within a NEPA-required Programmatic Environmental Impact Statement Analysis, along with the immediate availability of a viable, energy efficient FTTP alternative.

**Collaborative Innovation**

We also stand at the threshold of an innovation revolution in optical fiber wired technologies that will integrate effectively and efficiently both wired and wireless applications. Here are some examples:

- **Streamlined optical fiber to the edge** is making optical fiber connectivity affordable and accessible to everyone, providing a new pathway for 4G/5G backhaul, bringing fiber

[46] For extensive discussion see Julian Gresser, *Partners in Prosperity — Strategic Industries for the U.S. and Japan* (1985).

optic data from the antenna to the premises.This technology obviates the need for trenching, and can deliver optical fiber to the home at a cost-effective pace. This innovative technology has been recognized by the National Science Foundation and the U.S. Army.

- **Single Pair Ethernet (SPE) and Power Over Ethernet (POE).** As described in Dr. Schoechle's Declaration, these two technologies are establishing a standard and driving innovation toward a more ubiquitous wired infrastructure, rendering the deployment of 80,000+ satellites even less necessary.

**Present Rules and Their Defects as Applicable to Satellites**

The present FCC regulations governing public rural broadband auctions are at: FCC Adopts Procedures for Rural Digital Opportunity Fund (RDOF) Auction.

The FCC's regulations fail to address the Rural Digital Divide in a balanced way. They do not reflect the agency's systematic assessment of the costs and benefits of a satellite-based wireless infrastructure versus FTTP alternatives. They fail to require oversight by the FCC on its own grants. The regulations are designed so that only wealthy corporations can bid on the projects, rather than specifically supporting local municipal ownership and control. In that way municipalities can choose to go all optical-fiber and forego massive cell tower wireless infrastructure with all of its harms. In the case of SpaceX, the auction system is a taxpayer funded giveaway to underwrite the company's product marketing costs, which under a competitive economic system should be borne by the company itself.

A recent report by the consulting firm, Cartesian, commissioned by the Fiber Broadband Association (FBA) reaches the following conclusions:

- Even under the most generous interpretations, SpaceX will not be able to deliver efficient, reliable, low latency, Above Baseline service to the rural communities it is being subsidized for.

Although not explicitly addressed, the findings in the Cartesian Report also suggest that:

- Subsidizing satellite companies with taxpayer funds will not solve the desperate needs of economically disadvantaged intracity minority communities for fast Internet access;
- The subsidies fail to address the powerful demographic shifts under way, where millions of Americans who are demanding reliable fast Internet service are moving to suburban communities.
- Satellites must be continuously maintained and replaced as they die out and pollute the atmosphere. Once installed, optical fiber broadband requires much less maintenance.
- Unstable, untested, and unreliable satellite-based service is poorly suited to a world which is increasingly confronting pandemics and other health crises, whereas Fiber Broadband offers a reliable and effective technology to meet 21st century challenges.

**NEPA as a Framework for Principled FCC Decision Making in Auctioning Grants for the Satellite Experiment**

If the FCC had conducted a comprehensive Environmental Impact Statement Analysis prior to launching its precipitous public auction, as NEPA requires, the deficiencies of the untested, unproven Satellite Experiment would be obvious. The FCC would have had the benefit of specialized expertise within federal, state, and local governments, the corporate sector, and the general public. But it did not conduct such an assessment, which has produced the unbalanced and unfair present giveaways of public dollars.

The FCC's current public auction program, which discriminates against local municipalities and extends unsupervised grants to satellite companies, will substantially increase the risks of the environmental harms detailed in this Petition. **The FCC's current auction system is itself a major federal action, one integral part of a far larger FCC comprehensive blanket licensing program.** In itself, the Rural Broadband Auction system requires a comprehensive NEPA Environmental Impact Statement. As the FCC has not even considered conducting such an assessment, nor consulted meaningfully with any of the above mentioned concerned agencies whose missions and jurisdictions will be directly and adversely affected, the FCC's action is a violation of NEPA, the APA, and other laws and treaties mentioned in Proposal # 4.[47] For the reasons already cited, the FCC cannot evade its obligations by an arbitrary, unreasonable, and unsupported categorical NEPA exemption.

**Proposed New Rules and Regulations**

- The FCC should pause the implementation of all present and future grants under its Rural Broadband Program until: a) Satellite companies can offer proof and guarantees that the claims being made for the projected high level services and coverage for rural

[47] The failure to conduct proper NEPA analysis on billions of dollars in grants under a regime which favors wireless purveyors and satellite companies over optical fiber companies raises a similar legal question of whether the FCC must prepare similar Environmental Impact Statements under NEPA regarding its Auction system for allocations of frequency spectra. This issue is now being contested in France in an action initiated by the associations PRIARTEM and AGIR POUR L'ENVIRONNEMENT, assisted by lawyers François Lafforgue and Hermine Baron of the firm TTLA et associés, inviting the Council of State to ask a preliminary question to the Court of Justice of the European Union (CJEU). At the public hearing on Friday, December 18, 2020 the public rapporteur supported the Petitioners' argument that the decree setting the conditions for issuing and using frequencies in the 3.5 GHz band in mainland France could be considered a plan or program having an impact on the environment and, as such, requires a prior strategic environmental assessment. If the Council of State follows the opinion of the public rapporteur, the Court of Justice of the European Union will then have to rule on this question, which could have an impact on the deployment of 5G not only in France but also potentially in other European Union countries.

communities can actually be delivered, in light of cited data to the contrary;[48] b) The public costs and benefits of the Satellite Experiment are properly assessed; c) meaningful consultations with other federal and state agencies, tribes, international organizations, and concerned foreign countries are conducted; and d. effective public hearings and other forms of public engagement are carried out.

**CODA**

The legal and policy deficiencies of the Rural Broadband Auction Program as it applies to wireless companies are beyond the scope of this present Petition, which is concerned primarily on the Satellite Experiment. We focus here only on those specific areas where the FCC's New Rules can strongly encourage its grantees to accelerate FTTP solutions. The more vigorously these are implemented through job-creating, public/private partnerships with local municipalities, the more apparent the unwieldy, wasteful, and unnecessary nature of the Satellite Experiment will become.

**Summary**

The present auction system for Rural Broadband grants will not solve the Rural Digital Divide. The present system does not require any oversight by the FCC; it leaves the government funded infrastructure project entirely in the hands of corporations rather than local municipalities; it is designed so that only the wealthy corporations can bid on the projects; and it disregards the excellent policy prior analysis conducted by the FCC itself and other federal agencies supporting local municipal ownership, control, and decision making over communications and infrastructure.[49]

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[48] See e.g. Starlink RDOF Assessment, February 8, 2021.
[49] *Op cit. Reinventing Wires*.

**Principles for Continuing FCC Oversight of Existing and Future Grants for Rural Broadband to Wireless Companies with Optical Fiber Divisions**

Although we do not propose detailed New Rules, the following Principles can assist the FCC in this area.

- The FCC must continue to exercise oversight, remembering always that grants are taxpayers' money.
- Wherever possible and feasible, the FCC must encourage safe and secure FTTP solutions, paying special attention to encouraging solutions that support local economic growth, along with new and meaningful jobs in local communities.
- To the extent that wireless/optical fiber companies are claiming and implementing more environmentally safe and secure solutions such as point-to-point wireless, the FCC must require these companies to assess and mitigate the risks to exposed human populations and environmental impacts, as a condition of receiving and implementing grant awards.
- Wherever feasible the FCC should encourage its grantees to recognize local municipal ownership, control, and decision making over local Internet/communications infrastructures.
- The FCC should adopt and vigorously implement a new policy to support local communities in designing and developing their own sustainable power/communications utilities, based on and integrating innovative, renewable energy technologies.
- By effecting this pivot, the true costs and benefits of the Satellite Experiment will readily become evident and transparent, and the FCC can claim deserved credit for hastening its demise.

**Important Policy Questions**

- What are immediate public benefits that will be generated by the FCC's implementing a fair and balanced competitive bidding process to encourage municipal ownership, control, and decision making of local internet infrastructure, for its present $9.2 billion subsidy program, and future initiatives to bring broadband to Rural America?
- How can this program be turned into an engine for collaborative innovation, economic growth, and meaningful non-routine jobs?
- What are the most successful precedents for public-private partnerships that the FCC must encourage its grantees to adopt with local municipalities?
- What other federal and state agencies must be consulted to capture the optimal benefits of this extraordinary opportunity?
- Why must the FCC rectify this situation immediately before present funds are deployed and future funds are committed?

**Proposal #6: Strengthening Export Controls to Reduce Military Conflicts in Space. The FCC must address the accelerating militarization of Outer Space being enabled by its blanket licenses, without effective export controls, to commercial satellite companies whose dual use technologies can easily be re-deployed for military purposes.**

The FCC must conduct a Comprehensive and Systematic Risk Assessment in consultation with other concerned federal agencies — the Department of Commerce, the Department of State, NASA, DHS, Cybersecurity Infrastructure Agency (CISA), EPA, DOA, DHS — whose sign-off must be required prior to approvals of new satellite launches. Bilateral

and multilateral negotiations must immediately begin with other governments, especially in the East Asian Region, to put in place agreements to establish an effective early warning system to reduce the risks of military conflicts, while promoting peaceful, life-enhancing uses of new strategic technologies, such as AI, in Outer Space.

**Essential Security Challenge**

The FCC's present piecemeal licensing of 80,000+ satellites and millions of earth stations is accelerating a Space Race with profound military and commercial risks in a regulatory no-man's-land. As noted by Ann Finkbeiner in an article in the November 2020 Scientific American, *Orbital Aggression*, "by stepping into space, we have become vulnerable." She lists several military options that will enable enemies to attack and to disable whole constellations: a DA-ASAT assault missile, a maneuverable satellite like the Russian Cosmos 2542; or more subtle military uses of electromagnetic radiation to jam satellite systems, either in space or from earth. The problem is greatly aggravated by the fact that:

1. Many satellite components and systems have dual military and commercial uses, as discussed directly below.
2. There is rapid diffusion and easy availability of small satellites in the private hands.
3. The lack of resilience of the entire infrastructure. In other words, a sharp attack on a strategic node of vulnerability can have massive and cascading consequences on the entire satellite infrastructure.The impact of the recent cyberattack against the U.S. on the resilience of the satellite infrastructure has yet to be assessed.

**The Dual Use Dilemma**[50]

The fact that many of the products, technologies, software, and data associated with commercial satellites also have dual use (commercial and military applications) significantly compounds and complicates the risks of the Satellite Experiment.

- The Satellite Experiment depends on a wireless infrastructure embedded with dual use capability, and commercial satellites today are likely (undoubtedly classified information) performing clandestine military functions.
- These military capabilities are increasingly moving into private hands.
- The satellite infrastructure is cyber-insecure which means that hostile countries or domestic terrorists can easily divert and seize operational control of these inherent military capabilities.
- Cyber-insecurity is increasingly vulnerable to Artificial Intelligence ( AI) systems, especially developed in China, that emphasize massive data analytic capabilities.

**Who Benefits?/Who Pays?**

As noted previously, the principal financial beneficiaries are a few satellite companies. The launch of 80,000+ commercial satellites and millions of earth stations are not critical for military defense. Military experts are in the best position to assess defense requirements. These should not be conflated with, or dependent upon commercial ambitions of private companies. Taxpayer monies can reasonably be justified and appropriated for urgent military applications. But the public should not be taxed to underwrite the risks of the untested, unproven, highly risky commercial satellite experiment — especially when this dual use satellite infrastructure is being

[50] Some important references are: (PDF) Dual-Use in a New Security Environment - The Case of Missiles and Space; and The global spread of dual-use technology; and China's pursuit of dual-use technologies.

promoted under the guise of peaceful commercial uses without transparency or informed public consent.

**Relevant International and National Law**

The United Nations and numerous nation states have recognized, since the 1980s and 1990s, the imperative of establishing a framework to govern the peaceful uses of Outer Space. This proposition has been embodied in a Draft Treaty for the Peaceful Uses of Outer Space, first proposed by China and Russia in 2008. On December 4, 2014, the General Assembly of the UN passed two resolutions on preventing an arms race in outer space:

- The first resolution: *Prevention of an Arms Race in Outer Space*, "call[s] on all States, in particular those with major space capabilities, to contribute actively to the peaceful use of outer space, prevent an arms race there, and refrain from actions contrary to that objective." There were 178 countries that voted in favor to none against, with 2 abstentions (Israel, United States).
- The second resolution: *No first placement of weapons in outer space*, emphasizes the prevention of an arms race in space and states that "other measures could contribute to ensuring that weapons were not placed in outer space."[6] 126 countries voted in favour to 4 against (Georgia, Israel, Ukraine, United States), with 46 abstentions including EU member States. The United States delegation has dismissed the proposed PAROS U.N. Resolution as a subterfuge by the Chinese and Russians.

Meanwhile, hostilities in Outer Space continue. On April 15, 2020 Russia conducted an anti-satellite test of its direct-assent missile system — a platform designed to intercept satellites in low Earth orbit. In response, representatives of the U.S. Space Command made a statement that Russia's space developments represent an ever-increasing threat to U.S. interests. While

analysts were unable to conclude whether Russia attempted to intercept an object or merely test a delivery vehicle, this is thought to be the 10th attempt to test this platform.

**National Export Control Laws**

U.S. Export control regulations cover export and re-export from third countries of designated classes of products, services, and data. These regulations are directly relevant to the FCC's program of granting blanket licenses to satellite companies. An excellent assessment conducted in 2014 can be found here. A primer on the relevant rules is here. The special responsibilities of the satellite industry for export and transhipment of products, software, technologies, and data involving dual use applications raises particular complex challenges. The clear lead agency is the Commerce Department, not the FCC. U.S. export laws make clear that the obligation to police export, re-export, and transhipment from third party countries lies upon the applicant. Similar regulations exist in other countries.

**Other Concerned Regulatory Agencies**

There has been no apparent serious outreach by the FCC as a precondition of satellite licenses to other statutory or regulatory agencies with deep interest and domain expertise, including Space Force, DOD, Department of Commerce (DOC), DOC's Export Control Administration, the Office of Emerging Security Risks at the State Department, Department of Homeland Security, and other concerned agencies noted in other sections of this Petition.

**The Committee on Foreign Investment in the United States (CFIUS)**

The Committee on Foreign Investment in the United States (CFIUS) is an interagency body including nine Cabinet members, two ex officio members, and other members as appointed by the President, that assists the President in reviewing the national security aspects of foreign direct investment in the U.S. economy. In 2018, prompted by concerns over Chinese and other

foreign investment in U.S. companies with advanced technology, members of Congress and the Trump Administration enacted the Foreign Investment Risk Review Modernization Act (FIRRMA), which became effective on November 11, 2018. This measure marked the most comprehensive revision of the foreign investment review process under CFIUS since the previous revision in 2007, the Foreign Investment and National Security Act (FINSA). On February 13, 2020, the Department of the Treasury issued final regulations that implement key parts of FIRRMA.

The Satellite Experiment is now red hot on Wall Street, as evidenced most recently by SpaceX's announcement of its successful completion of a private equity funding round of $850 million on February 16, 2021, sending the company's valuation to about $74 billion. From a perspective of this Petition there are two important issues which apply generically, not only to SpaceX. The core question is transparency. First, given the close coupling of national and international security with satellites, should SpaceX or any other satellite company be required to make transparent and in-depth disclosure of all foreign investors or other contacts that may raise national or international security questions under CFIUS guidelines, rules, and procedures?

Second, should CFIUS sign-off be required before the FCC dispenses public funds, such as the RDOF Auction Grants, to any satellite company with foreign investors, or financial obligations to parties that may raise serious CFIUS concerns? Petitioners answer these questions in the affirmative, and propose new rules to make these requirements explicit.

**Secure and Trusted Communications Networks Act of 2019 (Public Law No: 116-124 03/12/2020)**

The Secure and Trusted Communications Networks Act prohibits the use of federal funds to obtain communications equipment or services from a company that poses a national

security risk to U.S. communications networks. The Federal Communications Commission (FCC) must publish and maintain a list of such equipment or services.

Each communications provider must submit an annual report to the FCC regarding whether it has purchased, rented, leased, or otherwise obtained any prohibited equipment and, if so, provide a detailed justification for such action. The Act has been applied to ban use of federal funds for companies like Huawei, and most recently the FCC published a rule requiring removal and replacement of sensitive equipment.

As applied here, the question is whether the FCC is granting hundreds of millions of taxpayer dollars in subsidies to satellite companies whose equipment, products, technology, data, and software may include those of foreign manufacturers, presenting national security risks under the Act? Again, the purpose of this Petition is to urge an exploration of such questions for a reasonable period of time — 180 days — to give the Biden Administration, the satellite industry, and other stakeholders time to pause, become better informed, reflect, and change course, if necessary.

**Present FCC Rules**

At present there are no published FCC Rules on how the FCC plans to manage the uncontrolled re-deployment of dual use technologies, including products, software, and data for military purposes. The present lax FCC regime is accelerating the existing Space Race, and increasing substantially the risks of military confrontation, especially with China. It is further unclear how specifically the FCC is closely coordinating with the Commerce Department and securing its sign-off on all blanket licenses, elevation modifications, and other decisions by its International Bureau that involve export control concerns. As many of the products, technologies, data, and software are on the Export Administration's Control List,[51] the FCC, as

[51] Commerce Control List (CCL)

the lead agency, has the responsibility to require applicants to provide fully approved export and re-export licenses and other permissions.

**Proposed New Rules/Regulations, and Process Controls on Dual Use Technologies**

- The FCC must secure DOC sign-off on all blanket licenses to satellite applicants that involve controlled products, technologies, software, and data.
- The FCC, as the lead agency, must require satellite applicants, as a condition of any FCC license, to submit fully approved export and re-export licenses and other permissions from the DOC Export Administration.
- The FCC should contribute to a Presidential Advisory Task Force considering the national and international security risks from hostile country The Committee on Foreign Investment in the United States (CFIUS)

**Background Notes on President Biden's Advisory Task Force on Space Security**

- **Unfettered Control of Space is a Zero Sum Game.** The most basic first step is to recognize that "unfettered control" (current term used by the FCC) and dominance in Outer Space is the same policy of other countries, beginning with China. As noted in great detail in the comprehensive Report by the China Aerospace Studies Institute, China views Outer Space as a domain of its own highest national security.[52] This essentially defensive policy is rapidly transforming into an aggressive action plan according to a recent DOD assessment, Major Surprises in DoD's 2020 China Report to Congress (Sept. 1, 2020). The FCC cannot continue to proceed blithely granting blanket licenses to any bidder without proper consultation and coordination with other concerned agencies noted above and also without a coherent negotiation strategy and Action Plan for

[52] For an excellent review, see: William J. Broad, NYT January 24, 2021, How Space Became the Next 'Great Power' Contest Between the U.S. and China.

outreach to appropriate high level decision makers in the Chinese government and other national players in the Space Race. As recommended below, this diplomatic demarche to China should be implemented on an East Asia regional basis, involving China, Japan, South Korea, Taiwan, and Russia.[53]

- **The Particular Challenges from China in AI.** Any sensible FCC policy regarding the Satellite Experiment must take account of the special military/industrial/commercial challenges from China and be effectively integrated with the policies and programs of other federal agencies. Most significantly, the FCC must coordinate closely with the DOD's newly launched China Task Force headed by Dr. Ely Ratner, Special Assistant to Secretary of Defense, especially in light of the DOD's China Report to Congress (September 1, 2020).

- **Final Report on the National Security Commission on Artificial Intelligence**

  According to the recently released Report:

  > "China's plans, resources, and progress should concern all Americans. It is an AI peer in many areas and an AI leader in some applications. We take seriously China's ambition to surpass the United States as the world's AI leader within a decade…
  >
  > "The AI competition is also a values competition. China's domestic use of AI is a chilling precedent for anyone around the world who cherishes individual liberty. Its employment of AI as a tool of repression and surveillance—at home and, increasingly, abroad—is a powerful counterpoint to how we believe AI should be used. The AI future can bedemocratic, but we have learned enough about the power of technology to strengthen authoritarianism abroad and fuel extremism at home to know that we must not take for granted that future technology trends will reinforce rather than erode democracy."

  Clearly, the world stands at the threshold of an extraordinary new era of over $16 trillion of value creation. As the uniquely qualified Kai-Fu Lee describes in AI Superpowers and

[53] In light of the China-Russia Cybersecurity Non-Agression Pact, Russia is an essential party to these negotiations. See e.g. Countering Russian and Chinese Cyber-Aggression.

in his public lectures, its Engine will be a fusion of the power of true Human Intelligence Networks pioneered by the U.S. and practical implementation of deep machine learning involving massive data analytics, honed principally in the cutthroat competitive gladiatorial arena of the domestic Chinese market. The choice facing the two superpowers and the rest of the world is: Will this parallel striving by the two Superpowers for AI dominance soon degenerate into bitter conflict and war? Or can its energies be more imaginatively redirected to usher in a new age of global prosperity? And what will happen as AI increasingly plays a central role in Outer Space?

- The FCC's new Rules can take account of the challenges from China in AI from two different perspectives. First, to the extent that the Chinese Space Advantage Plan is bent on dominance, and AI leadership will play a critical role in advancing this strategy, the FCC's Rules must address and mitigate the risks. The focal point can be tighter export controls, along with enhanced funding support for Cyber AI Security solutions, coordinated with other agencies (CISA/NIST, Department of Commerce, White House Office of Science and Technology Policy).

  However, there is a brighter side, as well. As Kai-Fu Lee points out in a recent TED talk, the potential for AI to support non-routine, compassionate jobs is virtually unlimited. The U.S. and China can be healthy competitors and collaborators, and need not be enemies over AI. One important purpose of the proposed negotiations in East Asia must be to identify and invest in these most promising areas of common value creation.[54]

[54] See Julian Gresser, "Integral resilience: how artificial intelligence, social media, and distance learning can build happy, healthy, creative, and compassionate communities" in Journal of Technology Forecasting and Social Change. July 2020.

- **The State Department's Japan Industrial Policy Group (JPIG/1980-1981).** In designing a U.S. government response to China's accelerating advantages in AI in Space, an excellent precedent is the JPIG, which was established in 1980-1981 under the auspices of the East Asian Section of the State Department (under the authority of Assistant Secretary Richard Holbrooke). The Mission of the JPIG was to formulate a coherent and effective response to Japan's industrial challenge to the 64K RAM chip. The JPIG actively recruited experts in the U.S. government, representatives from eight Congressional Committees, the captains of industry, including Robert Noyce, Chairman of Intel, the president and CEO of Texas Instruments, the President of the National Semiconductor Association, and leading academic scholars from Harvard, MIT and the University of California (Berkeley). The JPIG produced a series of reports[55] which strongly influenced the U.S. response to Japan's ambitious program to promote its semiconductor industry, but even more significantly, U.S. policies relating to "strategic" industries[56] for decades after.
- The JPIG Initiative produced several lessons that can be directly helpful to the Biden Administration. First, effective public/private collaboration can really work if there is a clear and powerful mission, clear deliverable goals and measurable results, an enabling authority, effective team coordination and integration, and adequate funding. Second, no special act of Congress is required; a compelling challenge, colorable authority, and a public entrepreneurial spirit are sufficient. Third, whereas avoiding or managing an international Space Race is a far more complex challenge than designing and

[55] See Julian Gresser, High Technology and Japanese Industrial Policy, House Ways and Means Committee, 1981.
[56] See Julian Gresser, *Partners in Prosperity — Strategic Industries for the U.S. and Japan* (McGraw Hill, 1985).

implementing an effective industrial and trade policy for the U.S. semiconductor industry, the framework for analyzing strategic technologies and industries,[57] and the basic collaborative model are directly applicable to the design of an effective Negotiation Plan and its implementation with China and other countries.

- The most important action the FCC can take is to contribute constructively and creatively along with other agencies with domain expertise in a Presidential Advisory Task Force to open negotiations with Chinese counterparts, and representatives from other nations in negotiating an updated framework building on the foundation established by the Outer Space Convention of 1967 to address the current Space Race.
- The U.S. should use the PAROS U.N. Resolution as an important framework for the above discussions with China, Russia, and other countries and seriously consider signing the Resolution based on a positive commitment to cooperate by the Chinese, Russia, and other major countries involved in the Space Race.

**Important Policy Questions**

- What will a collaborative, positive-sum alternative to the present Space Race look like, beginning with an effective collaboration with China?
- How can the present FCC satellite program be more closely coordinated with U.S. export control regulations covering products, technologies, software, and data?
- If we can produce and begin delivering Covid-19 vaccines to millions of people within a year, why do we assume that other extraordinary feats are not possible, such as discovering more peaceful uses of Outer Space, for ourselves, future generations, and the

[57] A useful tool in identifying the most promising applications for AI and supporting them in was that will amplify and support economic growth is the "Trigger Method" , an invention that grew directly out of the earlier JIPG's work. See: Julian Gresser, *Partners in Prosperity — Strategic Industries for the U.S. and Japan* (McGraw Hill, 1985).

living natural world?

## CONCLUSION

The FCC's piecemeal program of granting blanket licenses to a few satellite companies for 80,000+ low orbit, non-geostationary satellites and millions of earth stations raises profound unexamined problems under international and federal law. It impinges on the missions and jurisdictions of well over fifteen other U.S. federal agencies, while presenting immediate and grave national and international security risks. The FCC should treat the Satellite Experiment for what it is: an untested, uninsured, ambitious, creative entrepreneurial project with little or no data on whether it will even work, much less succeed. Millions of people around the world are being required without their consent to assume the risks and to pay the costs of this Satellite Experiment. Let the FCC and the satellite companies first obtain, analyze, evaluate, and publish the data on the existing ~4,000 commercial satellites already in orbit, Then the Biden Administration, the Congress, other countries, and the international community will be in a far better position to decide whether and how wisely to proceed. But until such time, the intelligent and only legal course is to PAUSE, at the very least for 180 days, or another reasonable time period, before implementing any new licenses, modifications, grants, or other significant actions in furtherance of an unwise and irreversible Satellite Experiment that will shake the world.

Respectfully submitted,

*/s/ James S. Turner*
James S. Turner

*/s/ Julian Gresser*
Julian Gresser

Counsel for Petitioners

# DECLARATIONS

**Declaration by Ben Levi and Paul Héroux, Ph.D.**

**In regard to the SpaceX Starlink™ network**

Purpose: The purpose of this declaration is to point out deficiencies in the Radiation Hazard Report filed by Space X in support of the FCC's Radio Station Authorization and support an Environmental Assessment of the whole satellite/ground station program.

Credentials: Ben Levi (B. Sc) graduated summa cum laude in Engineering Science, and has worked in the Information Technology field for 35 years. He is a systems designer with a broad understanding of many aspects of engineering, and is qualified to comment on the satellite-based internet services programs.

Dr. Paul Héroux is a scientist with experience in physics (BSc, MSc and PhD), engineering (15 years), and the health sciences (30 years). He started his research career at Institut de Recherche d'Hydro-Québec in Varennes, Québec, an internationally reputed electro-technical laboratory. After rounding out his formation with courses in Biology and Medicine, he became interested in public health, and was appointed Associate Professor at McGill University's Faculty of Medicine, where he is the current Occupational Health program Director, and also Medical Scientist in the Department of Surgery of the McGill University Health Center.

**Background**

SpaceX has filed a Radiation Hazard Analysis:Fixed Customer Premises Earth Station Terminal report ("Report") that it is utilizing as a "routine environmental evaluation" to satisfy Rule 1.307, claiming no environmental impact from its deployment of one million ground-based customer premises terminals ("CP terminals") used to directly communicate to its Starlink satellite mega-constellation. This Declaration challenges the Report's conclusions. It refutes SpaceX's claim of no adverse environmental impact from the aggregated Radio Frequency Radiation (RFR) exposure of its proposed one million CP terminals. This Declaration contends that an Environmental Assessment is required for the whole satellite/terrestrial program, including the blanket license to SpaceX for one million earth stations.

**Maximum Permissible Exposure ("MPE")**

The FCC has set the Maximum Permissible Exposure limit for RFR for people living in the U.S., based on the OET Bulletin 65 from August 1997, at 1 $mW/cm^2$, or 10,000,000 $\mu W/m^2$. This MPE limit is predicated on the assumption that health risk is based only on thermal effects on tissues (specific absorption rate (SAR)), which was the industry consensus back in 1997. However, in the subsequent 20+ years, wireless radiation has increased exponentially, from second-generation (2G) cellular phone frequencies (<1.9 GHz) used sparingly among the public, to ubiquitous exposure of fourth-generation (4G, up to 6 GHz) and now fifth-generation (5G) frequencies in the range of 20 GHz and higher. Also since that time, there have been thousands of scientific studies confirming the adverse effects of non-ionizing radiation on living beings, including humans. Dr. Paul Heroux and others have compared the FCC's insistence on 1997-based MPE limits to more recent MPE limits set by other countries, and the differences are striking (units are $\mu W/m^2$):

| FCC | Austrian Medical | EUROPAEM for Sensitive Population | Bioinitiative |
|---|---|---|---|
| 10,000,000 | Peak < 1.0 | 0.1 | 1,000 (2007), 1.0 (2012) |

As Heroux and others have made clear, the FCC's MPE levels may be many orders of magnitude too high in order to protect the public from RFR harms. Still, 1 mW/cm$^2$ is the MPE limit for General Population/Uncontrolled Exposures to which the Report has stated each CP Terminal conforms, and it is that which will be addressed next.

**The Report's Power Density Calculations**

The maximum power density calculation was done at the Antenna Surface with Beam at Slant = 0.99 mW/cm$^2$ which is as close to the FCC's MPE limit as one can get (to the 2nd decimal place). It is fairly obvious that the numbers were manipulated in some fashion in order to keep the maximum just under the FCC's MPE limit, and the question is where? The answer is on page 1 of the Report with the duty cycle of the uplink transmissions, in which the report states:

> *"The duty cycle of the uplink transmissions is controlled by the network and independently monitored by the software controlling the CP terminal; this ensures that the transmit duty cycle of a terminal cannot exceed 11% under any circumstances.*"

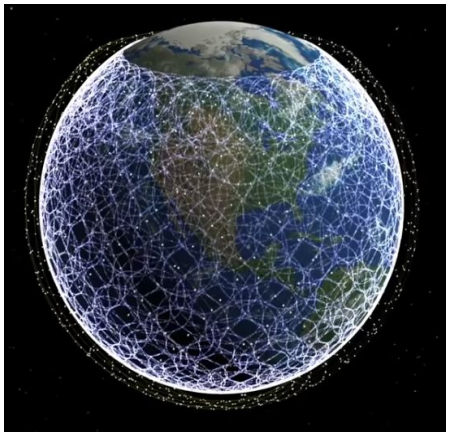
An extensive web search was unable to verify anywhere that every CP Terminal will have a maximum transmit duty cycle of 11% -- meaning that in any given time period, the antenna will only be transmitting (emitting RFR) a maximum of 11% of the time. Perhaps the Report's author is privy to information not publicly available, but it defies logic to assume that the transmit duty cycle will *never* exceed 11%. During operations such as file transfers, the duty cycle can be as high as 99% (e.g. here) Yet that number, 0.11, is *required to be that low,* in order to keep the Maximum Power Density with Beam at Slant under the FCC's MPE limit. If indeed it is reasonable to assume the maximum duty cycle would be much higher, say at least 8x higher if not more, then each CP Terminal would not only exceed the 1 mW/cm$^2$ MPE at the antenna surface (0.99 x 8 = 7.92 mW/cm$^2$), but also in Near Field (0.56 x 8 = 4.48 mW/cm$^2$) and Far Field (0.13 x 8 = 1.04 mW/cm$^2$) with Beam at Slant. Note that in most instances, the closest distance human beings will get to the CP Terminal will be somewhere between the Near Field length (2.78m) and Far Field (6.68m), but **once the transmit duty cycle is adjusted to a more appropriate level, it is clear that each CP Terminal will certainly exceed the FCC's MPE limit for RFR.**

**Uplink Issues**

On page 2, the Report states, "There is no difference in transmit power *between CP terminals* at the center or edge of the spot *or between clear sky or heavy rain conditions*." (emphasis added) This appears to be an error, in that CP Terminals are not designed to transmit and receive signals *between* one another -- every CP Terminal's communication is with one or more Starlink satellites, and then connected to the internet through an appropriate protocol such as Ethernet. According to SpaceX's FCC filing, "…these earth stations will transmit in the 14.0-14.5 GHz band and receive in the 10.7-12.7 GHz band." These frequency ranges are in the Ku band, which

is notorious for “rain fade” and “snow fade,” which requires that the CP terminal increase its power output in order to overcome signal degradation due to ice, clouds, rain, snow, etc. **Basically, the worse the weather conditions, the more RFR the CP terminal has to transmit in order to keep the connection to the satellite(s), and thus the more harmful RFR exposure to humans.** It goes without saying that the more satellites the CP Terminal remains in contact with during inclement weather, the higher the likelihood the CP terminal’s transmit power will be at a maximum.

**Downlink Issues**



As stated in the Application for Expedited Review, notwithstanding that earth stations and satellites form one wireless infrastructure, the FCC and applicant companies like SpaceX are approaching the program in a piecemeal fashion, seeking approval in each case without any regard to the whole. But as Professor Heroux mentions, the whole planet will be irradiated by thousands of SpaceX and other satellites, each beaming down RFR to many CP terminals and larger base stations in a many-to-many relationship, blanketing the Earth, and every living being on it with RFR. The consequences of this are totally unknown, and have never been modeled publicly, let alone studied. The above image depicts what this RFR blanket may look like.

The FCC is basically forcing every being on the planet to be irradiated with RFR, whether they consent to it or not. It should also be noted that research concludes there are currently no maximum transmit power limits for satellites, so the cumulative effect of tens of thousands of satellites all beaming down RFR, with no limits on power transmission, onto every living creature on Earth, is certainly something the U.S. government, and all governments, must study before subjecting the planet and all living things to RFR levels never before seen on Earth.

**Conclusion**

The Report by SpaceX does not accurately portray the RFR emissions from its CP terminals, which likely exceed even the FCC's MPE levels set over 20 years ago, and which it refused to reduce to lower limits just last December. A full Environmental Assessment must be done not only on the CP terminals, but on the whole satellite internet experiment *before* every living being on the planet is irradiated without their consent with RFR that has unknown health and environmental consequences. In the meantime, all earth station deployments should be postponed until such time as all of the issues stated herein have been addressed.

I declare under penalty of perjury that the foregoing is true and correct.
*/s/Ben Levi*
Ben Levi

*/s/Paul Héroux*
Paul Héroux


Ben Levi
151 Wildcat Ln.
Boulder, CO 80304
ben@dialogue.org
303-546-0679

Paul Héroux, PhD
Professor of Toxicology and Health Effects of Electromagnetism
McGill University Medicine
Department of Surgery, McGill University Health Center
InVitroPlus Laboratory
paul.heroux@mcgill.ca
(514) 398-6988

**Declaration by Stefano Gallozzi, Ph.D.**


My name is Stefano Gallozzi and I am a graduate in Physics specializing in Astrophysics and working as a Research Technologist for the Astronomical Observatory of Rome of the Italian National Institute for Astrophysics, INAF.

I have worked for more than ten years with the images of the great international telescopes, in particular the Large Binocular Telescope (LBT) located in Mount Graham in Arizona, and while working with the LBT images I found out how harmful the passages of the satellites were during scientific observations at the focus of biggest telescopes.

As soon as my colleagues and I learned of the intention to launch mega-constellations totalling more than 50,000 satellites into low earth orbit, we committed to try to move international scientific opinion that seemed to be ignoring the impacts.

In a personal capacity I created an international appeal for professional astronomers from all over the world and in a very short time I collected almost 2,000 signatures. In this appeal, I exposed many inherent problems that the mega-constellations of satellites will produce to astronomical observations and, within a short time, other expert colleagues working on data from other bands of the electromagnetic spectrum began to highlight additional problems with respect to the optical bands.

We have therefore published two papers highlighting all the damages we found that are produced by satellites' constellations that show up in astronomical observations from the ground:

Gallozzi | Concerns about Groud-Based Astronomical Observations: Safeguarding the Astronomical Sky | 3Feb2020.pdf

Gallozzi | Concerns About Ground-Based Astronomical Observations - Quantifying Satellites' Constellations Damages | 2Apr20.pdf

But this is not just some inconvenience; radio astronomy, for example, could be totally annihilated and unable to operate in a few years, despite the billion dollar investments for the large facilities on the ground.

Even in optics, investments funded by public money for large telescopes could suffer a percentage decrease in value proportional to the loss of scientific content of the observations made: if for some telescopes with medium-large field of view, it is possible to lose 60-70% of the science data produced within an observing night, this would have the same effect on the loss of value for the public investment committed to that ground based facility.

Each institution has invested different amounts of public money in astronomical ground based projects. Over the past two years for example, my institute, INAF, has invested around 100 million euros for ground projects; so the loss of economic value would be significant. These projections are best explained in this article.

The more satellites in orbit there are, the more this percentage of damage to the observations will necessarily grow, so if satellites density reaches a critical value, observations from the ground will become totally impossible, and all the tens of billions of euros / dollars spent so far will be permanently lost.

Clearly the fear is not only that of safeguarding a profession or of avoiding damage to public finances, but that of losing an immeasurable good for all humanity for the sake of commercial profit, which is why the astronomers' petition asks agencies and governments to take action in order to block any further satellite launches, and simultaneously to deorbit all low-orbit satellites launched to date, and to put in place and immediately execute an international moratorium on all exploitation of the sky for commercial purposes. We are 2,000 scientists who are clamoring for it and as promoter I am the spokesman for this appeal.

I declare under penalty of perjury that the foregoing is true and correct.
Stefano Gallozzi
*/s/ Stefano Gallozzi*

Osservatorio Astronomico di Roma - INAF
v. Frascati 33 – 00078 Monte Porzio Catone (RM)

**Declaration by Timothy Schoechle, Ph.D.**
**DECLARATION**

## Executive summary

Since the introduction of the telephone, a universal wired communication infrastructure continues to provide the most reliable, economical, sustainable, and resilient communications system that technology can offer. Today, that system relies primarily on optical fiber technology for long-haul data exchange—as well as for voice and video. However, continually advancing copper-wired Ethernet technology now offers to further complement the fiber networks by enhancing distribution of data within our homes, buildings, and factories. New versions of wired Ethernet not only deliver data at nearly the speed of fiber, but also deliver DC power to the devices that plug into it. This new innovation is known as Single-Pair Ethernet (SPE) with Power Over Ethernet (POE), also called Power over Data Lines (PoDL).

## Optical fiber-to-the-premises

Fiber-to-the-Premises (FTTP) has become a basic national public utility. It delivers high-speed data access to home or business at a data rate typically starting at about 1 gigabit per second (Gb/s). The fiber usually terminates at a gateway box outside or inside the home or building for distribution on-premises by copper wire to a wide variety of connected devices. Often such gateways separate the fiber data stream into appropriate connectors for three primary services—Internet, telephone, and TV[1]. For Internet data service, an Ethernet 4-pair RJ-45 modular connector and Category 5 (CAT 5)[2] cable running within the building is used. For telephone service, a twisted pair wire and RJ-11 modular connector, with two or 4-pair solid copper wire within the building is used. For television/video service, a coaxial cable connector and coaxial cabling within the building is used.

## Premises Internet data distribution

Conventionally, the Ethernet cable, usually CAT 5, then is run through the building to appropriately located RJ-45 sockets on the wall. For those desiring premises wireless access, a WiFi router can be connected to the CAT 5 cable from the gateway using an RJ-45 connector. Most computers have an RJ-45 connector, and other devices often have a USB connector that can be used with an adapter.

## New standard provides power over Ethernet

Along with FTTP, new cheaper and faster versions of Ethernet for Internet distribution within homes and buildings, along with DC power delivery to the device, are now becoming available. The standard is known as “Single-Pair Ethernet” with “Power-Over-Ethernet” (SPE/POE or PoDL). This allows portable devices such as smartphones and tablets to operate in “wired” mode with faster, more reliable access, and also charge their batteries at the same time when plugged into the premises Ethernet network. It may also allow users to avoid cellular wireless access charges, minutes, or data caps. It may also avoid some cellular commercial tracking/surveillance.

## New standard provides cost effective, reliable choice

The recently published IEEE Standard 802.3cg™ 10BASE-T1 Single Pair Ethernet standard provides three cost-effective and reliable choices for commercial/industrial applications—to not only provide low-voltage DC power, up to about 50 Watts per cable run, for sensors and actuators, but also provide high speed data communications. This enables the elimination of batteries and wireless links and wireless power transfer for simple sensors and other devices. It also enables a "multidrop" or "bus" wiring topology, in contrast to conventional Ethernet topology.[3]

Versions for commercial and industrial applications, available now:

IEEE 802.3cg – 10 Mb/s

- 10BASE-T1S – Link segment (point-to-point), 4 connections, 15m reach, PoDL power
- 10BASE-T1L – Link segment (point-to-point), 10 connections, 1000m reach, PoDL power
- 10BASE-T1S – Mixing segment (multidrop), 8 nodes, 25m reach, no PoDL power

Version for residential or small building applications, another standard is being developed, planned for completion in 2022 or 2023:

IEEE 802.3da – 10 Mb/s Multidrop Enhancements

- 10BASE-T1S – Mixing segment (multidrop), 16 nodes, 50m reach, PoDL power

Single Pair Ethernet equipment and device interfaces offer a smaller footprint than traditional 4-pair RJ-45 Ethernet connections. With components roughly half the size of the traditional 4-pair Ethernet, SPE offers a simple and efficient solution for smaller devices. Additional benefits of the standard include:

1. Supports both point-to-point as well as multi-drop bus topologies providing flexibility to allow transition of legacy non-Ethernet applications to Ethernet.
2. Extends the reach of Ethernet copper LAN cabling up to 1000 m allowing perimeter cabling inside the building, as well as networking devices/sensors outside the building.
3. Expands Standard IEEE 802.3bu™ Power over Data Lines (PoDL) classes to facilitate up to 7.7 watts of DC power at distances of 1000 m. Shorter reach classes (15 m) allow up to 50 watts of PoDL DC power over the same balanced single pair cabling used for data.
4. Ethernet use of the seven-layer OSI model continues in the IEEE 802.3 SPE applications, with several layers of security built into the protocol, extending robust security down to the device level.
5. Operation and Administration of the network by personnel familiar with Ethernet becomes much easier and more reliable compared to the wide variety of legacy Operational Technology (OT) networks, many of which are proprietary.

**Conclusion**

For consumers and businesses of all kinds, Single-Pair Ethernet with Power over Ethernet (SPE/POE) completes the path from the Internet all the way to their devices with an entirely wired solution for intelligent buildings and homes.

- Could replace legacy fieldbus technology
- Replace RS485 based systems supporting access control and HVAC control
- Ideal for devices requiring limited power and low bandwidth
- Sensors for air quality, occupancy, ambient light levels, temperature, lighting control
- Eliminate wireless sensors/devices and their batteries
- Improve maintainability and reduce costs
- Improve reliability
- Improve security and privacy
- Improve energy efficiency
- Improve sustainability

I declare under penalty of perjury that the foregoing is true and correct, to my best knowledge and belief.

2021-02-15

*/s/Timothy Schoechle*
Timothy Schoechle, PhD
3066 6th Street
Boulder, CO 80304
timothy@schoechle.org

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[1] Also referred to as "voice, video, and data" or the "triple-play".

[2] Category 5 cable contains twisted 4-pair solid copper wire with certain specified shielding/noise characteristics. Higher numbered categories carry improved characteristics.

[3] "multidrop" means that the wire pair can be tapped at any point to add nodes to the link, rather than using a point-to-point "star" topology for each link, as is the case with the current Ethernet standard.

**Declaration by Bruce Gagnon, Co-founder**
**Global Network Against Weapons & Nuclear Power in Space**

**History of concern**

The Global Network was founded in 1992 – at that time headquartered in Central Florida. The organization is made up of 150 local organizations across the US and around the world as well as hundreds of individual members.

Our goal is to prevent the nuclearization and weaponization of space and to protect the space environment from devastation. We are particularly concerned about the growing problem of space debris and the implications for life on Earth given that so much human activity relies on satellites that are increasingly in grave danger from destruction by debris fields in orbit.

In addition the increased damage to the ozone layer by mounting numbers of launches threatens all life on Earth.

There is presently no process in place to ensure that Environmental Impact Statements be required to protect the people and the planet from the environmental impacts of escalating numbers of launches.

We believe the FCC's lax regulatory oversight of space operations is in direct violation of the very goals and purposes of the Global Network.

In 1989, 1990 and 1997 we went into federal court to block NASA from launching space missions carrying deadly payloads of plutonium-238 on the Galileo, Ulysses and Cassini missions. Support for our efforts came from organizations and individuals worldwide who recognized that any accidental release of the toxic payloads could cause global harm.

**Crowded orbits**

In 1978, NASA scientist Donald Kessler warned of a potential catastrophic, cascading chain reaction in outer space. Known as "Kessler Syndrome," the theory posited that orbits above Earth could one day become so crowded, so polluted with both active satellites and the junk from past space missions, that it could render future space travel problematic and even impossible.

Even NASA has recently formally commented on a request by a US company to build and launch a mega-constellation of satellites at an altitude of 720km above the Earth's surface, citing concerns about collisions. This appears to be the first time that NASA has publicly commented on such an application for market access, which is pending before the Federal Communications Commission.

"NASA submits this letter during the public comment period for the purpose of providing a better understanding of NASA's concerns with respect to its assets on-orbit, to further mitigate the risks of collisions for the mutual benefit of all involved," wrote Samantha Fonder, an engineer for the space agency.

Rocket Lab CEO Peter Beck reports the company is already beginning to experience the effect of growing congestion in outer space. The sheer number of objects in space right now (a

number that is quickly growing due to SpaceX's satellite internet constellation, Starlink) is making it more difficult to find a clear path for rockets to launch new satellites.

**Ozone depletion from launches**

As the number of space launches increase, rocket engine emissions grow in proportion. Rocket engine exhaust contains gases and particles that can affect Earth's climate and ozone layer. These emissions historically have been assumed to be not much of a threat to the global environment because the space industry was considered small. Dilution was the solution to space travel pollution.

Every type of rocket engine causes some ozone loss, and toxic rocket exhausts are the only human sources of ozone-destroying compounds injected directly into the middle and upper stratosphere where the ozone layer resides.

Future ozone losses from unregulated rocket launches will eventually exceed ozone losses due to chlorofluorocarbons, or CFCs, which stimulated the 1987 Montreal Protocol banning ozone-depleting chemicals.

"As the rocket launch market grows, so will ozone-destroying rocket emissions," said Professor Darin Toohey of Colorado University-Boulder's atmospheric and oceanic sciences department. "If left unregulated, rocket launches by the year 2050 could result in more ozone destruction than was ever realized by CFCs."

**More spaceports 'needed'**

Due to the rush to launch tens of thousands of new satellites into orbit there is a mad push to create more spaceports around the world. In many cases pristine environments on Earth are being negatively impacted by the construction of these launch facilities, for example Kodiak Island, Alaska. Currently there are efforts to build such facilities underway in Hawaii, Scotland, Maine and more. The process of delivering and storing toxic rocket fuels to these spaceports creates huge environmental problems as the fuel leaks into local water tables. Across the nation the chemical Perchlorate (used in the production of rocket fuel) has become evident in milk and lettuce and the Colorado River has become laced with the chemical.

**Ignoring United Nations Space Treaties**

The US (and other nations) are ignoring the UN's Moon and Outer Space Treaties which hoped to create some regulation of space exploration activities. Now essentially we have the Wild West – everyone for themselves – in space. As a result of this situation of non-regulation we are facing severe consequences that in most cases have no solutions.

**Militarization of space**

Increasing militarization of space, as the military and intelligence agencies sign 'dual use' contracts with 'civilian' satellite operators, is essentially making most operating satellites military targets. A war in space is becoming more likely as the US and allied nations create their 'Space Forces' so they can 'control and dominate' the heavens. The consequences of blowing up satellites guarantees that the space debris problem becomes impossible to deal with and

essentially shuts down all satellite operated activities on Earth because our techno-world today is linked and controlled by satellites.

**Apollo astronaut warning**

In 1989, while working for the Florida Coalition for Peace & Justice (a founder of the Global Network) we organized a protest at the Kennedy Space Center in Florida. Our keynote speaker that day was Apollo 14 astronaut Edgar Mitchell who spoke out against war in space. Mitchell told the assembled that any war in space would be the "one and only" because so much debris would be created that the orbits above Earth would be like a 'minefield' or a 'Piranha laced river' which would 'entomb' us to the planet because no rocket would be able to get through this field of debris.

**Regulation necessary**

National & international regulations are urgently needed to guide the program of commercial and military rocket launches in the future.

The only way to deal with our current space crisis is to begin to regulate the launch process to ensure that we deal with the ozone depletion and orbital crowding situations. Unless this is done then it is quite certain that in our lifetime we will witness catastrophic events that space experts have been warning about for years.

To continue to disregard these warnings is the height of irresponsibility.

**Recommended viewing**

We strongly recommend that the court and the FCC view the award-winning documentary entitled *Pax Americana & the Weaponization of Space* which reviews most of these issues that we are concerned about. It can be found on YouTube at https://www.youtube.com/watch?v=5LUPcdM2boM&t=60s

I declare under penalty of perjury that the foregoing is true and correct.
*/s/ Bruce Gagnon*
Bruce K. Gagnon
Coordinator, Global Network Against Weapons & Nuclear Power in Space
PO Box 652
Brunswick, ME 04011
207-389-4606
globalnet@mindspring.com

## Member Organizations by Country

### USA

Action Center for Justice (NC)
Alliance for Survival (CA)
Berrigan House-Des Moines Catholic Worker
Brandywine Peace Community (PA)
Broward Citizens for Peace & Justice (FL)
Center for Peace & Justice (NM)
Charlottesville Center for Peace & Justice (VA)
Citizen Soldier (NY)
Citizens Democracy Watch (OR)
Citizens for Peace in Space (CO)
Cleveland Peace Action (OH)
Coalition for Peace & Justice (MI)
Code Pink Maine
Concerned Citizens of Laguna Woods Village
Connie Hogarth Center for Social Action (NY)
Copper Country Peace Alliance (MI)
Cultures of Resistance Network Foundation
Cumberland Center for J & P (TN)
Delray Citizens for Social Responsibility (FL)
Detroit Province of the Society of Jesus (MI)
Dr. Michio Kaku
Dr. Patch Adams (IL)
Earth Rights Institute (CA)
East Bay Peace Action (CA)
Environmental & Peace Education Center
EPEC (Lehigh Acres, FL)
Environmental Defense Institute (ID)
GE Stockholders Alliance (AZ)
Global Peace Foundation (CA)
Global Resource Action Center for the Environment (NY)
Glynn Environmental Coalition (GA)
Grandmothers for Peace International
Grandmothers for Peace, Northland Chapter
Grandparents for Peace (FL)
Gray Panthers of Washtenaw (MI)
Greater New Haven Peace & Justice Coalition
Ground Zero Center for Nonviolent Action
Healing Ourselves & Mother Earth (CA)
Institute Justice Team (MI)
Ithaca Coalition for Global Justice (NY)
Jonah House ( MD)
Kauai Alliance for Peace and Social Justice
Kennebunk Peace Department (ME)
L. A. Catholic Worker (CA)
LEPOCO Peace Center (PA)
Merimac Valley People for Peace (MA)
Montrose Peace Vigil (CA)
Native American Rainbow Network (MN)
Nebraskans for Peace (NE)
Nevada Desert Experience
No Nukes North – Alaskan Coalition
North Carolina Peace Action (NC)
North Country Coalition for J & P (VT)
North Shore Coalition for Peace & Justice
Nuclear Free Takoma Park Committee (MD)
Nuclear Resister (AZ)
Nuclear Weapons Abolition Task Force
Nukewatch
OREPA (TN)
Oxford Citizens for P& J (OH)
Pacific Campaign for Disarmament & Security
Pax Christi Florida (FL)
Pax Christi Maine (ME)
Pax Christi Rochester (NY)
Peace & Nat'l Priorities Center ( MI)
Peace Action Cleveland (OH)
Peace Action Maine (OR)
Peace Action of MI (MI)
Peace Coalition of Southern Illinois
Peace Links of Elkhart County ( IN)
Peace Resource Center of San Diego (CA)
PeaceWorks (ME)
PeaceWorks Kansas City (MO)
People's Action for Clean Energy (CT)
People's Music Network
Phillip Berrigan (MD)
Polk County Citizens for P & J (FL)
Primghar Peace Links (IA)
Promoting Enduring Peace (CT)
Save Our World (VT)
School Sisters of Notre Dame JPIC (MN)
Secure World Foundation (CO)
Sisters of Loretto Disarm Econ Conversion
Sisters of St Francis of Tiffin (OH)

Sisters of St Joseph of Carondelet (MO)
Sisters of the Presentation (ND)
Socialist Party (NPA)
Space Treaty Institute (CA)
Stop the War Machine (NM)
The Community for Human Development
The Nuclear Resister (AZ)
The Peace Report
Touchstone Gallery (NC)
U.S. Peace Council (CT)
U.S.-Vietnam Friendship Assn (CA)
Unitarian Universalist – Social Action Committee (CA)
Ursuline Sisters of Tildonk (NY)
Veterans for Peace (FL)
Veterans for Peace (ME)
Veterans For Peace (MN)
West Midwest Justice Team (MI)
Western States Legal Foundation
WILPF (MA)
WILPF (NAT'L) (PA)
WILPF (CA)
WILPF (CA)
WILPF (FL)
World Beyond War

**Argentina**

Movement for Life & Peace

**Australia**

Australia Anti-Bases Campaign Coalition (Sydney)
Byron People for Peace & Justice (Byron Bay)
Helen Caldicott, M.D. pediatrician, Founding President PSR
Marrickville Peace Group
Ozpeace (Melbourne)
Pax Christi Australia (Victoria)
People for Nuclear Disarmament (Perth)

**Austria**

P.L.A.G.E.

**Azerbaijan**

Azerbaijan Women & Development Center

**Argentina**

Movement for Life & Peace

**Bangladesh**

Bangladesh Astronomical Society

**Canada**

Annapolis/Digby Peace Group (Nova Scotia)
Brandon and District Labour Council (Manitoba)
Canadian Voice of Women for Peace (Toronto)
Dr. Joan Russow Nat'l Leader Green Party
Dr. Rosalie Bertell, GNSH (Toronto)
Halifax Peace Coalition (Halifax)
No War Coalition (Winnipeg)
Peace Alliance Winnipeg
WILPF-B.C. (Vancouver)

**England**

Campaign for Nuclear Disarmament (CND) (London)
Headingley and Kirkstall CND (Leeds)
Leicester CND
Manchester CND
Menwith Hill Accountability Campaign
Merseyside CND (Liverpool)
Trident Ploughshares 2000 (Norwich)
Oxford CND
Peace Moves Coalition (Cornwall)
Scientists for GLobal Responsibility

Tower Hamlets CND
Yorkshire CND (Bradford, England)

**Europe**

Dr. Caroline Lucas, Green Party MEP, European Parliament

**Fiji**

Bangladesh Astronomical Society

**France**

LIFPL
Mouvement de la Paix

**Germany**

Darmstadter Friedensforum Germany
Dialog International (Dusseldorf)
Feuergruppe (Berlin)
Friedens- und Begegnungsstatte Mutlangen
IPPNW
Pax Christi Gruppe (Ravensburg)

**Ghana**

Green Earth Organization

**India**

Centre for Cultural, Educational and Economic Social Studies (Nagpur, India)
Global Network Chapter – Visakhapatnam, India
Indian Institute for Peace, Disarmament & Environmental Protection
Movement Against Nuclear Weapons, Chennai (Madras), India
Rural Development & Youth Training Institute (Kota, India)
SEEDS

**Iraq**

Iraq Pledge of Resistance

**Italy**

No MUOS Niscemi
Shalom

**Japan**

Youth & Student Group of Osaka Peace Committee

**Mauritius**

Mauritius Action for Disarmament & Peace

**Mexico**

Latin American Circle of International Studies

**Nepal**

Centre for Community Development & Environment Research
Global Network Chapter
Social Development Path, Nepal (SODEP)

**New Zealand**

Peace Movement Aotearoa

**Nigeria**

GOLHD Centre (Global Network for Human Development, Nigeria)
Int'l Ctr for Regional & Ethnic Conflict Resolution (Nigeria)

**Norway**

Norwegian Peace Association
WILPF

**Romania**

MAMA TERRA/For Mother Earth
Sibienii Pacifisti

**South Korea**

Civil Network for a Peaceful Korea
SPARK

**Sweden**

Attac Sweden
Swedish Peace Council

**Switzerland**

Int'l Peace Bureau (Geneva)
Int'l WILPF (Geneva)

**Wales**

CND Cymru
Wales Alliance Against Nuclear Weapons
Wales Network for Peace & Justice

Americans for Responsible Technology
184 Main Street • Port Washington • New York • 516.883.0887 • www.AmericansForResponsibleTech.org

**Declaration by Americans for Responsible Technology**
**Re: FCC Petition for Emergency/Expedited Rulemaking regarding the agency's approval of thousands of space-based satellites and millions of Earth stations**

Americans for Responsible Technology ("ART") is a project of Grassroots Communications, a 501 (c) (4) not-for-profit organization serving as an umbrella organization and resource for more than 140 grassroots groups across 43 states. We are opposed to the unfettered deployment of wireless technologies using radiofrequency (RF) radiation because of proven harm to human health and the environment, as well as the infringements on the right of individuals to determine how and to what extent new technologies will be integrated into our lives. We support the implementation of safe, reliable and fully-tested technologies and an open and transparent process for decision-making.

**Universal Connectivity is a Goal We All Share**

There is little debate that the internet has transformed the way we live. In just the span of a generation, we have learned new ways to work, learn, shop, listen to music, stay in touch with family and even influence elections. It has spawned entirely new industries and caused the demise of others. It's hard to imagine any part of our world that has been unaffected by the transformative power of the internet.

And yet people in many parts of the world currently lack access to high-speed broadband internet connectivity, putting them at a social, economic and cultural disadvantage. The challenge to the world community is how to connect those people in a way that doesn't jeopardize our personal and national security, inflame international relations, negatively impact our fragile environment, subject humans to known health risks without their knowledge or consent, infringe on the activities of scientists or further pollute our already crowded skies. The current trajectory of decision-making at the Federal Communications Commission fails all of these basic tests.

**Wireless Radiation is Not Harmless**

Several decades of independent scientific research, including a recent $30-million-dollar study conducted by the National Toxicology Program of the National Institutes of Health, have proven beyond any doubt that exposure to radiofrequency (RF) radiation, even at levels considered safe by government agencies, can inflict biological harm on animals and disrupt a number of natural systems in ways we don't yet fully understand. Thus, the theory that harm from RF radiation is limited to the heating of human tissue, which has been the operating assumption for all regulation and legislation regarding wireless technology for more than 30 years, has been proven false.

While purveyors of technology are harnessing RF radiation to achieve breakthroughs in communications unimaginable even a decade ago, it's what they don't know about this energy force that makes the current path being followed by the FCC both dangerous and reckless.

**Things We Don't Know**

Engineers at Space-X and other new entrants in the space communications business have figured out how to build fantastic new devices that can receive and transmit signals from hundreds of miles above the Earth, as well as the amazing technology required to launch and return powerful rockets. But it's what they don't know that should concern everyone back on Earth. Like every human endeavor that purports to improve on nature, the race to create a "constellation" of new satellites to beam signals back and forth to Earth will have unintended consequences. We just don’t know the extent of these consequences....yet.

Over hundreds of millions of years, life on Earth developed by adapting to natural ambient radiation levels and using the Earth's magnetic fields to develop precise navigational systems. How will the rapid increase of powerful new man-made wireless signals from outer space influence the migration of birds, or the navigational abilities of pollinators? How will proximity to millions of powerful Earth-based transmitters impact nearby plants and wildlife, not to mention people, particularly those who are sensitive to RF radiation?

Until purveyors of space-based communications have successfully investigated these and other key issues, the approvals being issued by the FCC are wildly premature and irresponsible.

**A Better Solution Already Exists**

Most of the world is connected to the internet via fiber-optic cable. A complex network of underwater cables already connects every continent on earth, and terrestrial cables crisscross the planet like a spider web. These cables provide lighting-fast, economical, safe, secure and private internet connections for billions of people. But cable can be expensive to install, and telecoms across the globe made calculated decisions about where it made financial sense for them to run cable, and where it didn't. This decision was often influenced by the fact that services provided by cable were regulated, whereas services provided by wireless technologies were not.

In our view, the deployment of fiber-optic cable to more remote regions of the world, or even to city neighborhoods that remain without broadband access, is a much superior solution than the deployment of tens of thousands of privately-owned satellites, with all of the unknowns such an endeavor entails. Fiber-to-the Premises (FTTP) is a reliable, safe, fast, and economical long-term solution embraced by consumer groups around the world. Expanding this worldwide network should be the priority of the FCC, not spending tens of millions of taxpayer dollars helping entrepreneurs develop a new worldwide market for themselves.

**Conclusion**

It is the job of industry to create new goods and services that can make money for investors. It is the job of government to protect the public interest by monitoring the activities of industry and

regulating or prohibiting those which may pose serious threats to society. We have outlined in this document some of the many threats posed to the world by the current "race to space" being conducted by the wireless industry. Yet instead of acting in the public interest to carefully monitor and control these activities, and with a total lack of experience, resources and authority, the FCC has taken it upon itself to join with industry to engage in a “ready-fire-aim” policy that could have permanent and devastating consequences for all life on Earth.

Under penalty of perjury, I declare that the foregoing is true and correct to the best of my knowledge and belief.

Douglas Wood
*/s/ Douglas Wood*
Director
Americans for Responsible Technology
c/o Grassroots Communications, Inc.
184 Main Street
Port Washington, NY 11050
daw@grassrootsinfo.org

**Declaration by the Bonobo Conservation Initiative**

**Re: FCC Petition for Emergency/Expedited Rulemaking regarding approval of 80,000+ satellites and millions of earth wireless communication stations**

The Bonobo Conservation Initiative (www.bonobo.org) is a U.S. non-profit 501(c)(3) organization whose mission is to protect the endangered bonobo and its habitat in the Congo rainforest. For more than twenty years, we have been establishing and expanding the Bonobo Peace Forest, a connected network of community-based nature reserves in the Congo Basin. To date, working with the government of the Democratic Republic of Congo and local, indigenous communities, we have officially protected over nine million acres of rainforest with several more sites in development.

## Environmental & Biological Risks

The Congo Basin is home to the world's second largest rainforest, sometimes referred to as "the second lung of the Earth." The forest's role in mitigating climate change is immense; the trees, plants, and peat bogs sequester billions of tons of carbon[58,59]. The Congo Basin also harbors countless species of animals and vital watersheds; its protection is vital in maintaining the planet's biodiversity.

Our long years of work in the field have made us keenly aware of the interconnectedness of the Congo rainforest ecosystem. Our founding mission was to protect the endangered bonobo, one of humankind's closest great ape relatives, sharing almost 99% of our DNA[60]. It was immediately clear that protecting bonobos requires preserving their habitat and working with local communities to protect the forest that is their home. The necessity of the forest to the bonobos is readily apparent; what is less obvious is how necessary bonobos are to the forest. Many major tree species—including those that sequester the most carbon—rely on bonobos for seed dispersal and germination[61]. For this critical role, bonobos are known as "the gardeners of the forest."

The connection between bonobos and the trees is but one strand in the complex web that is Congo rainforest ecosystem. Any disruption to the delicate balance of the forest could have catastrophic effects not only on bonobos, but on the health of the planet itself.

We write to express our support of the Healthy Heavens Trust Initiative and its petition calling for the FCC to ensure that proper scientific testing and procedural due diligence is carried out to

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[58] Xu, L., Saatchi, S.S., Shapiro, A. *et al.* Spatial Distribution of Carbon Stored in Forests of the Democratic Republic of Congo. *Sci Rep* **7,** 15030 (2017)

[59] Dargie, G., Lewis, S., Lawson, I. *et al.* Age, extent and carbon storage of the central Congo Basin peatland complex. *Nature* **542,** 86–90 (2017)

[60] Fruth, B., Hickey, J.R., André, C., Furuichi, T., Hart, J., Hart, T., Kuehl, H., Maisels, F., Nackoney, J., Reinartz, G., Sop, T., Thompson, J. & Williamson, E.A. 2016. *Pan paniscus* (errata version published in 2016). The IUCN Red List of Threatened Species 2016: e.T15932A102331567.

[61] Beaune, F.B, L. Bollache, *et al*. Ecological services performed by the bonobo (*Pan paniscus*): seed dispersal effectiveness in tropical forest. *Journal of Tropical Ecology* **29**,367-380 (2013)

assess the environmental and health impacts of the proposed deployment of 80,000+ low-orbiting satellites by a few satellite companies, as well as millions of Earth-based receiving/transmission devices (e.g. satellite dishes). Although much more research needs to be done, there is ample evidence of the debilitating and disruptive effects of overexposure from Electro-Magnetic Fields (EMF) on bees and other pollinators, migratory birds, and trees. Likewise, there is a growing body of scientific proof of the harms of EMF radiation on human health. There are also relevant concerns about the pollution and harms the low-Earth-orbit (LEO) satellite constellations may cause in the Earth's atmosphere and ozone layer, further exacerbating climate change. As climate change accelerates, weather prediction will become increasingly vital. Current research indicates that EMF radiation may interfere with the frequencies used by weather sensors on satellites, significantly hampering meteorologists' ability to make accurate weather forecasts[62,63].

As an organization working to sustain whole ecosystems, and indeed ecosystems that provide services critical to the survival of the entire planet, we are concerned about the potential negative impact of the massive deployment proposed. It is reckless to deploy 80,000+ low-orbiting satellites and millions of earth stations without first objectively assessing the risks they may present to the health of ecological systems upon which all life depends.

### Economic Risks

We are also concerned about the economic risks associated with potential degradation to forest ecosystems. The Congo and the Amazon rainforests alone sequester many billions of tons of carbon, regulate rainfall and weather patterns around the world and harbor critical watersheds. Thus, they provide ecosystem services and "natural capital" that are now being recognized and quantified in world markets. As the UN and the nations of the world are coming together to address the existential threat of climate change, major corporations, including the world's largest energy, tech, and telecommunications companies are committing to reaching net zero emissions. One way many of these corporations plan to offset their carbon emissions is by investing in carbon offsets, or carbon credits. The market for REDD+[64] (Reduced Emissions from Deforestation and Degradation) carbon credits is growing rapidly. The value of forest carbon credits is determined by the amount of carbon sequestered by the forest measured in metric tonnes per year. Even small reductions in the ability of these forests to sequester carbon would reduce the value of the carbon credits, resulting in negative economic consequences on global markets. In turn, this would reduce much needed income to rainforest countries, indigenous communities, and organizations like ours who are working with them, thus compromising our collective ability to preserve the rainforests and the biodiversity within them.

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[62] Witze, A. Global 5G wireless deal threatens weather forecasts. *Nature* 575, 577 (2019)

[63] Rutgers University. 5G wireless may lead to inaccurate weather forecasts. *ScienceDaily*. (2020). www.sciencedaily.com/releases/2020/09/200924082706.htm

[64] UN-REDD Programme. What is REDD+? (2020). https://www.unredd.net/about/what-is-redd-plus.html

Payment for Ecosystem Services (PES), through REDD and other mechanisms, are necessary in order to ensure that the forests can continue to provide the ecosystem services the world requires. A large proportion of funds is allocated to local and indigenous communities, who are the stewards of this land, as well as the provincial and national governments. The Democratic Republic of Congo, along with other rainforest nations in Africa, South America, Southeast Asia and Indonesia, are depending on these investments as significant factors in their GDP in the years to come. Thus, they have a large stake in any activity that could impact the forest asset.

In the next 10-15 years, natural climate solutions are projected to provide more than a third of the emissions reductions needed to hold global warming to less than the 2 degrees centigrade tipping point, according to Forest Trends Ecosystem Marketplace, the leading global source for information on environmental finance, markets, and payments for ecosystem services. Major investors are seeking to purchase emission reductions for the next ten to thirty years. The time to pause and to responsibly assess the potential environmental impact of the satellite and earth station deployment is now, rather than to suffer irretrievable damage in the future.

**Moral & Legal Implications**

The massive deployment of this EMF technology in the heavens and on Earth may threaten our planet's natural support systems. The fact that it is being deployed without the free, prior and informed consent of citizens of the USA and the world, nor without proper scientific testing to safeguard our health is injudicious. Beyond that, nature itself and non-human species have a right to exist without undue and dangerous interference. There is a burgeoning international movement to acknowledge the "Rights of Nature" as evidenced by legislation by a growing number of national and local governments, as well as the "Harmony with Nature" resolution adopted by the United Nations.

The extinction of bonobos would be particularly poignant; they are a living example of how our closest living relatives have developed caring communities based on peace, kindness, generosity and love. In a world of increasing discord and conflict, the fact that bonobo communities are matriarchal is not inconsequential.

**Conclusion**

We call on the FCC to halt further deployment of SpaceX satellites and related earth stations until the environmental impacts of this technology are adequately and objectively assessed. It is universally acknowledged that we have a very short timeline to mitigate the existential threat of climate change. The actions the global community takes over the next decade are critical to future generations of humans and other species. This is not the time to allow the reckless and unregulated deployment of EMF-emitting technology before its environmental impacts are thoroughly assessed.

I declare under penalty of perjury that the foregoing is true and correct.

Sally Jewell Coxe
*/s/Sally Jewell Coxe*

President, Bonobo Conservation Initiative
2701 Connecticut Ave, NW #702
Washington, DC 20008

## Healthy Heavens Trust Declaration

**Whereas** five Federal Communications Commissioners (FCC) have granted a few privately held companies blanket license to deploy over 80,000 low-orbit non-geostationary satellites and millions of earth stations;

**Whereas** the FCC's piecemeal actions are accelerating a Space Race that jeopardizes national and international security;

**Whereas** the U.S. government has already recognized some of the national and international security risks involved (collisions, cybersecurity, debris), but has no public comprehensive plan to mitigate them;

**Whereas** the FCC is offering billions of dollars in direct subsidies, and trillions in indirect subsidies through lax or no regulation of unproven, untested technologies;

**Whereas** the FCC is allowing satellite companies to proceed without indemnification or insurance, and no provision whatsoever made for compensation to the public (Public Pays Principle);

**Whereas** all nation states hold the integrity of the Heavens in sacred Public Trust, and therefore must act as stewards and fiduciaries for this Public Trust (this principle being enshrined in a framework of international treaties, international customary law, and national laws);

**Whereas** the FCC, as a fiduciary, has a duty to be well informed and to consult with other U.S. government agencies, Congressional oversight committees, other governments and international organizations, and to hold public hearings;

**Whereas** the FCC must comply with all federal and state laws and international treaties (including safeguards for human and environmental rights) that it is violating by its unilateral actions;

**Whereas** the FCC's flagrant disregard for international law will accelerate other governments' mercantilist trade policies and violation of human rights, climate change, and environmental conventions. The FCC cannot authorize 80,000+ satellites and not expect other countries to do the same;

**Whereas** optical fiber and other wired options offer well proven, safer, more reliable, cyber-secure, environmentally protective solutions to internet access;

**Now therefore**, we, the undersigned organizations, strongly support the Petition for Emergency/Expedited Rulemaking to the FCC to effect a pause in all satellite licensing and launches, until a full assessment of the security risks and long-term harms is made. It is a violation of fundamental rights of humanity and all life to sacrifice the Heavens for the benefit of a few satellite companies and their shareholders without exploring more reasonable and balanced alternatives.

December 14, 2020

**Healthy Heavens Trust Organizational Signatories (partial list)**

"Our Land, Our Water, Our Future"
#WaterIsLife / The Waters Connect Us
5G Free California
5G Free Marin
5G International Legal Action Network
5GFreeOregon.org
5P (Peace Partners for People, Plants and Planet)
A Call to Actions
Acacia Books
Alijansa Za Zajedničko Dobro
Aloha Freedom Coalition
Association Wishing To Continue Analog Meters
Associazione Astrofili Elbani
Associazione ElettrosmogVolturino
Associazione Italiana Elettrosensibili
Associazione Iterineo
Awareness group non-ionizing radiation Apeldoorn
BAST Bermuda Advocates for Safe Technology
BONA ONA - Asociación de información y divulgación sobre las radiaciones no ionizantes en las Islas Baleares
California Brain Tumor Association
Canadians for Safe Technology
Center for Safer Wireless
Charleston Coalition for Wireless Safety Standards
Citizens Action for Safe Energy
CLEAR: Citizen League Encouraging Awareness of Radiation
Coalition to Reduce Electropollution (CORE, since 1992)
Collectif stop5G.be
Coloradans for Safe Technology
Connexion-U
Consumers for Safe Cell Phones
Corner Garden
Down to Earth
EcoC2S
Ecological Options Network
Electromagnetic safety Alliance, Inc.
elektro-sensibel.de
EM Radiation Research Trust
Energy Conscious LLC
Environmental Health Advocacy LEague (ENHALE)
FACTS- Families Advocating for Chemcial and Toxics Safety
Farm Life Foundation
Friends of Merrymeeting Bay
Global Network Against Weapons & Nuclear Power in Space
Gopal & Pedigo, PC
Gulf Islanders for Safe Technology (GI4ST)
Healthy Home Advisor
Healthy Safe-G Philippines
Holden HealthCare Ltd
https://www.stopumts.nl
HWAGD!TO Hugpungan para sa Wasto, Ganda, Disente at Ligtas na Tahanan.org
Keep Baldy Wild
Keep Your Power
Last Tree Laws
Lazoo Entertainment
Life Resonance, z.s.
Life-Environmental Network
Maine Coalition to Stop Smart Meters
MalibuForSafeTech.org
Michigan Safe Technology
Napa Neighborhood For Safe Technology
National Toxic Encephalopathy Foundation
NY4Whales
Oregon for Safer Technology
Patras Citizens' Committee for the protection of Health from Electromagnetic Radiation
PLATAFORMA CIUDADANA QAE
Postversa
Quebec's Coalition Against Electromagnetic Pollution
Rådet for Helbredssikker Telekommunikation / Council for Health Safe Telecommunication - Denmark
Raphael Medicine & Therapies PC
Résistance 5G Nantes (france)
Robin des toits Bretagne
Safe 5G Mendocino

Safe Technology for Santa Barbara County
SafeG Alliance
SafeHome
Santa Barbara Body Therapy Institute
Santa Barbara Green Sisters
Schweizerischer Verein W.I.R.
Scientific Alliance for Education
Stop 5G Encinitas
Stop 5G International
STOP 5G STROUD
Stop5GSandySprings.com
SustainableBusiness.com
Swansea Vegans Environmental
The Danish EHS Association
The Human Connection Institute
The Ross County Network for Children
ThePeoplesInitiative.org
University Resarch Associates, LTD
Urban Impressionz Inc.
UXO Clearance Laos
Vitastiq
We Are One, Inc. - www.WeAreOne.cc - WAO
WIreless Radiation Education & Defense, WiRED
Women's Medicine Bowl, LLC
Yoga For Peace, Justice, Harmony With the Planet, Amazing Amy: Eccentric Yoga Entertainer
Znews Limited

## Appendix 1 — List of Authorities


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**Treaties**


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UN Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies 25, 48

UN Declaration of Human Rights 36

Vienna Convention for the Protection of the Ozone Layer of 1985 47

World Heritage Convention 49

Migratory Bird Treaty 49

Stockholm Convention 50

Rio Declaration 50

1966 International Covenant on Economic, Social and Cultural Rights 51

1972 Stockholm Conference on the Human Environment 52

Aarhus Convention 53

## APPENDIX 2 — Leading Risk Assessment Practices

There is a rich body of best methodologies and best practices which the FCC can draw upon in addressing the national and international security risks of the satellite program.

**General**

- **77 FREE RISK ASSESSMENT FORMS, TEMPLATES and APPS**
- **Risk management tools — Victorian Managed Insurance Authority, Australia**

**Nuclear Risk Assessment**

- **Google Search — "risk assessment" nuclear plants earthquake**
- **Probabilistic Risk Assessment - Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants - NCBI Bookshelf**

**Emergency Management**

- **FEMA National Risk Index**
- **Hazard and Risk Assessment - USGS**
- **www.usgs.gov › natural-hazards › earthquake-hazards**

**COVID Risk Assessment**

- **COVID-19 Event Risk Assessment Planning Tool**
- **COVID-19 Symptom Check**

**Additional Risk Management Links**

- **Improving government policy on risk: Eight key principles**
- **An Assessment of Important Issues Concerning the Application of Benefit-Cost Analysis to Social Policy | Journal of Benefit-Cost Analysis**
- **Analysis of Global Change Assessments: Lessons Learned**
- **Policy failure and the policy-implementation gap: can policy support programs help?**
- **Union of Concerned Scientists — Space Debris**
- **International Association for Impact Assessment, www.iaia.org and Bulletin of the Atomic Scientists:**
    - **As Russia stalks US satellites, a space arms race may be heating up**

- **“Big, fat, juicy targets”— the problem with existing early-warning satellites. And a solution.**
- **Can space weapons protect US satellites?**

## APPENDIX 3 - Text of Proposed New Rules

**Proposal 1: Conduct Comprehensive Whole System Risk Assessment**

**(a) This rule temporarily pauses implementation of the agency's Streamlining and Licensing Procedures which can be found at:**

Commission's Report and Order, IB Docket No. 18-86; FCC 19-81, adopted on August 1, 2019, and released on August 2, 2019. The full text of this document is available on the Commission's website at Streamlining Licensing Procedures for Small Satellites.[65] This document also includes a summary of the Commission's subsequent Order, IB Docket No.18-86, FCC 20-60, adopted on May 8, 2020, and released on May 11, 2020. The full text of this document is available on the Commission's website at FCC Adopts Small Satellite Rules.[66] This document additionally announces that, on February 27, 2020, OMB approved, for a period of three years, the information collection requirements relating to the part 25 rules contained in the Commission's Report and Order, FCC 19-81, also published in this document. The OMB Control Number is 3060-0678.

(b) The FCC will extend its full cooperation to a newly commissioned Presidential Interagency Task Force charged, among other responsibilities, with producing within 180 days a Comprehensive Whole Systems Assessment of all major risks associated with its blanket licensing program, as identified in FCC Petition for Emergency/Expedited Rulemaking (insert docket #).

(c) All applicants for new licenses, whether for new satellite launches, deployments, elevation modifications, base and earth stations must, as a pre-condition of any license, provide their own risk assessment, mitigation, indemnification, and insurance plans

[65] https://www.fcc.gov/document/streamlining-licensing-procedures-small-satellites-1
[66] https://www.fcc.gov/document/fcc-adopts-small-satellite-rules-effective-date-clarification-order

under penalty of perjury. Applicant risk assessments must contribute to and be reasonably consistent with the overall planning process and Risk Management Plan produced by the FCC and based on the Comprehensive Risk Assessment.

(d) Applicants must attest that the data and other documents provided in these risk assessments are true to their best knowledge, under penalty of perjury.

**Proposal #2—Prevent Satellite Collisions and Other Accidents**

**This rule amends the FCC's Streamlining Order in the following respects:**

**(a) Subpart F (paragraphs 93-97): Revised Bond Requirement.** The NPRM sought comment on the proposal to adopt a one-year "grace period," applicable to small satellite streamlined licensees, during which the licensees would not need to post the surety bond required under the Commission's rules. The FCC adopted the NPRM proposal. This new rule cancels this decision and requires all satellite applicants immediately and without exception to post 1) a surety bond; 2) at significantly higher levels reflecting a fair and accurate assessment of the risks; and 3) specifying the classes of beneficiaries covered by the bond.

(b) **New Paragraph 98: Indemnification and Insurance.** Satellite constellation applicants are immediately required as a condition of all licenses to sign an indemnification agreement and provide proof of insurance, monetarily commensurate with the risks, to cover collisions and accidents resulting from space debris and other potential hazards noted in this Section.

(c) **New Paragraph in Section 7 Casualty Risk after Paragraph 59**: Satellite applicants are hereby required to provide the FCC with a Plan specifying the detailed measures the applicant will take as a condition of its license to mitigate these risks. Licensees shall provide the FCC and other concerned agencies with real time data to assist these agencies in developing more effective policies and programs for accident prevention and mitigation. Applicants shall provide

yearly reports on significant investments they have made in developing innovations in satellite safety and accident prevention.

**In the Matters of Mitigation of Orbital Debris in the New Space Age Mitigation of Orbital Debris IB Docket No. 18-313 IB Docket No. 02-54 (Terminated) NOTICE OF PROPOSED RULEMAKING AND ORDER ON RECONSIDERATION Adopted: November 15, 2018 Released: November 19, 2018**

**Paragraph 77-78 Hereby Revised:**

> (77) As the lead agency the Commission recognizes and accepts its responsibility under the 1972 Outer Space Liability Convention for claims for damages resulting from operations licensed under its authority and control, to the extent that other signatories to this same Convention do the same for operations licensed under their jurisdictions.
>
> (78) Space station licensees must immediately indemnify the United States against any and all costs associated with a claim brought against the United States related to the authorized facilities.

**<u>Proposal # 3: Intensify Cybersecurity</u>**

The following new rules, further conditioning the Application Streamlining Process, are hereby added as Paragraphs 71-72.

**Paragraph 71.**

(a) All satellite applicants must contract with the FCC to provide indemnification to the U.S. government and private parties, and present proof of adequate insurance coverage, designating classes third party beneficiaries of such insurance.

(b) Applicants must present a Cybersecurity Mitigation Plan identifying the risks noted in the December 2020 Space Directive and Solarium Report[67] and effective steps to control and to mitigate them.

[67] https://www.solarium.gov/report

(c) Applicants must certify compliance with all new Rules developed through the interagency consultative process required by the Secure 5G and Beyond Act, the Space Satellite Policy Directives, and a new Presidential Task Force.

**Paragraph 72.**

(a) All satellite applicants shall be required to prepare a CyberSecurity Privacy Protection Plan that ensures full compliance with the European General Data Protection Regulation Standard (GDPR), as applied to satellites, as well as base and earth stations. The Plan shall include regular reporting obligations on the status of compliance, and a commitment to use best available Cybersecurity measures, technologies, and protocols, and to upgrade continuously. Failure to maintain Cybersecurity privacy protections responsibly shall result in immediate revocation of the FCC license, and full public disclosure by the applicant. The FCC may require additional bond, indemnification, and insurance conditions in order to compensate victims of data privacy abuses.

**CISA Emergency Directive 21-02 (March 3, 2021)**

Beginning immediately, CISA sign-off will be required pursuant to CISA Emergency Directive 21-02, March 3, 2021 — Mitigate Microsoft Exchange On-Premises Product Vulnerabilities on all FCC licenses, approvals, modifications, or other actions that entail substantial risks of hacking or other breaches of national security.

**Proposal # 4: Prepare Comprehensive Programmatic Environmental and Health Assessment.**

**Satellite Program a Major Federal Action under 40 CFR § 1508.18.**

(a) The FCC recognizes that all satellite, base, and earth station licenses, orbit approvals, modifications, Rural Broadband Auction grants, Radiation Hazard Report standards and implementation, and other piecemeal actions constitute a major federal action as defined in 40 CFR § 1508.18.

(b) The FCC recognizes its obligations under the National Environmental Policy Act (NEPA) of 1970 and will immediately initiate interagency consultations, and where appropriate international consultations, in preparing a Comprehensive Programmatic Environmental Impact Statement addressing the specific environmental and public health issues and concerns raised by the Petition for Emergency/Expedited Rulemaking, Viasat Corporation, and other concerned parties.

(c) All Radiation Hazard Reports (RHR) submitted by applicants shall be based on the FCC's Comprehensive Programmatic Environmental Impact Assessment. RHR must be supported by a signed Affidavit under penalty of perjury, subject to fines beginning with $1 million for each infraction, and criminal penalties.

(d) Applicants are hereby required to submit detailed manifests with full disclosure of the contents of payloads and fuels that contain toxic, hazardous, or explosive materials, including mercury, aluminum, and plutonium, or computer software used or deployable in the construction or deployment of nuclear weapons.

(e) The FCC hereby requires satellite applicants to demonstrate proof of implementing reasonable Mitigation Measures urged by the SKA Administration to prevent or to

reduce significant harms to astronomical research identified in its October 2020 Risk Assessment.

(f) Applicants under penalty of perjury must certify full good faith compliance with the proposed FCC's Comprehensive Environmental Impact Statement, including all mitigation measures, offering tangible evidence and proof of said averred compliance.

**Rescission of 7 CFR § 1.1306.**

(a) The FCC hereby withdraws and rescinds its categorical exemption under 7 CFR § 1.1306 as applied to blanket licenses of satellites and associated base and earth stations.

**Proposal # 5—Apply Neutrality Principle to Rural Wired Broadband**

**Rural Digital Opportunity Fund 904 Auction (New Rule "I") (AU Dockets:20-30, WC: 19-126, 10-90)**

(a) The FCC affirms its policy of Neutrality and careful consideration of all viable alternatives in designing and implementing its Rural Digital Opportunity Fund.

(b) The Rural Broadband Digital Opportunity Fund is in itself a major federal action, which is an integral part of a larger federal action consisting of licenses for thousands of satellites and millions of base and earth stations. (40 CFR § 1508.18) The FCC is currently engaged in preparing a Comprehensive Programmatic Environment Impact Statement on the Rural Broadband Digital Opportunity Fund pursuant to its obligations under the National Environmental Policy Act of 1970. Consequently, all present and future grants under its Rural Broadband Program are postponed until:

(i) Satellite applicants receiving grants can offer proof and guarantees that the claims being made for the projected high level services and coverage for rural communities can actually be delivered, in light of cited data to the contrary;

(ii) All services will be dedicated to RDOF communities, not diverted to other markets;

(iii) Some use of funds will be allocated to addressing the needs of economically disadvantaged intra-city minority communities for fast and secure Internet access;

(iv) The public costs and benefits of the Satellite Experiment are properly assessed;

(v) Meaningful consultations with other federal and state agencies, tribes, international organizations, and concerned foreign countries are conducted; and

(vi) Effective public hearings and other forms of public engagement are carried out.

**Proposal # 6: Strengthen Export Control Coordination and Management Over Dual Use Technologies in Space**

(a) As the lead agency, the FCC recognizes its responsibility to ensure that all satellite applicants are in full compliance with the Department of Commerce's Export Administration's regulations pertaining to the export and reexport of products, technologies, data, and software on the Control List.[68]

(b) The FCC will henceforth secure DOC sign-off on all blanket licenses to satellite applicants that involve controlled products, technologies, software, and data.

[68] https://www.flexport.com/glossary/commerce-control-list/; https://www.bis.doc.gov/index.php/licensing/commerce-control-list-classification/commerce-control-list-ccl/17-regulations/139-commerce-control-list-ccl

(c) All satellite applicants, as a condition of any FCC license are required to provide approved and final export and re-export licenses and other permissions from the DOC Export Administration. This regulation shall be retroactive to January 2019.

(d) As of this date, all FCC satellite licenses for satellite launch, deployment and operations, elevation modifications, base and earth stations will be subject to sign off by CFIUS and clearance under the Secure and Trusted Communications Networks Act of 2019.

## APPENDIX 4 — Safeguarding the Astronomical Sky Foundation (SASF) Background

Ground-based astronomical observations will be severely damaged by the ongoing deployment of large fleets of satellites to ensure the functioning of future telecommunications technologies.

For centuries, ground-based astronomical observations have brought exceptional advances in our scientific understanding of the Laws of Nature. Currently, the capabilities of ground-based astronomical instrumentation are endangered by the persistent deployment of fleets of telecommunications satellites.

Through this international appeal and following up on the same concerns expressed by the **International Astronomical Union, IAU [1]** and other institutional subjects, we raise a series of formal requests regarding greater protection and safeguarding for professional astronomical observations from the ground, guaranteeing to astronomers, the right to observe a sky free from sources of light and artificial pollutants.

Specifically, the adherents of this foundation (environmental association, individual professional or amateur astronomers, astronomical institutions and national astronomical societies), wish to express their concern and their opposition concerning the coverage of the sky produced by artificial satellites, which dramatically risk to degrade the scientific content of a wide range of astronomical observations.

In fact, there is not only the light pollution of the sky due to the dispersion of light from the cities and the most populated areas of the planet, but also due to the fleets of artificial satellites, which cross and irremediably mark the observations with very bright parallel streaks / trails. at all latitudes.

Many astronomers are extremely concerned about the possibility that the Earth could be covered by tens of thousands of satellites, which will greatly exceed the approximately 9,000 stars, which are visible to the naked eye. Unfortunately this is not a distant threat or the prospect of a distant future, but it is already happening now. The American private company SpaceX has already put 1,000 of these small satellites, called Starlink, in the sky and plans to constellate the entire sky in total with about 42,000 satellites (at three different altitudes: 340km, 550km and 1150km). Therefore, together with other telecommunication space projects planned for the near future (e.g. OneWeb, Samsung, Telesat, Amazon, Lynk and Facebook, Roscosmos, CASC etc.), more than 60,000 small satellites could be positioned in orbit, which will orbit the Earth, at different altitudes, with different objectives related to the telecommunications industry, and which will mainly provide satellite Internet.

These new satellites are small, mass-produced and will orbit very close to Earth, providing a fast Internet connection with low-latency signals. But this proximity (~340km altitude), when illuminated by the Sun, will also make them more visible and brighter in the night sky (in fact, the current 1,000 Starlink satellites are already brighter than 99 percent of the population of objects visible from terrestrial orbit ). [12].

It should be noted that the number of artificial objects currently cataloged (and visible) in the sky does not exceed 20,000, including functioning objects and floating debris; so with Starlink satellites alone this total number will at least triple.

In the medium and long term, this will drastically reduce our view of the Universe, create more space debris, and deprive humanity of a pristine view of the night sky. It has been calculated, [12], that many of these satellites will be visible to the naked eye (with a brightness between the 3rd and 7th apparent magnitude, i.e. reaching the brightness of the stars in the constellation Ursa Minor and exceeded in brightness by only 172 stars in the whole sky!). They will be extremely brighter in the hours immediately following the sunset and in any case, with 50,000 satellites, the "normality" will be a sky crowded with artificial objects (a satellite in each square degree of sky, which will cause crawls, frustrating and compromising the observations for the whole the night in particular for naturalistic and astronomical photography and professional medium-wide field instruments).

Although observations with wide-field telescopes (for example LSST [2] or VST [3] or Pan-STARRS [4], ...) will be the most affected, even deep and low-field exposures will be damaged, see image and [7], also because during the twilight the calibration images are acquired which will be the most affected and damaged by the phenomenon, nullifying the possibility of obtaining scientific images calibrated during the night.

Another relevant issue concerns the impact on the security of our planet, since large-field astronomical observations / surveys of the sky are commonly used in NEOs (Near Earth Objects) monitoring / research programs, it would be more problematic if not impossible to identify and monitor the objects potentially at risk of impact for the Earth: with these satellite constellations the ability to prevent and/or prepare humanity for a possible catastrophic event from impact with unspecified celestial objects.

This light pollution is extremely harmful for astronomical observations at all wavelengths.

Visual brightness mitigation techniques for satellites proposed by involved companies have proved inadequate and have only helped to buy time in order to continue to send more than a hundred satellites into orbit per month. These proposed mitigation techniques did not sufficiently decrease the brightness of the satellites in orbit, which is still too high for professional astronomical ground based observations (see [12]). Furthermore, the degradation to scientific observations will remain high for two further reasons:

1. the stars and other objects in the universe will still be eclipsed, thus altering the timing in the variability studies, and

2. the reflectivity of the satellite surface necessarily depends on the observing wavelength, so what becomes dark in one part of the spectrum (for example the visible) remains bright (or shines) in other parts of the spectrum (for example infrared or radio); moreover, a darker surface also means greater capture of solar heat with consequent overheating of the satellite body and consequent re-radiation in the IR.

It should also be noted that such a fleet of non-geostationary low-orbit satellites provides, at nominal operating speed, a **replacement rate of from 2000 to 8000 Starlink satellites per year**, which would be irremediably left to disintegrate in the lower earth's atmosphere, risks and consequences of the case, without to mention the problems inherent in any collisions that would drastically increase space debris, with the not remote possibility of establishing a chain reaction , called Kessler's syndrome (see [13]).

It is also important that the development of the latest generation telecommunication networks (both from space and from Earth), already profoundly influences radio astronomy observations (in all observational sub-bands): with the LEO satellite fleets it is feared that the situation will become unbearable. One of the most important radio astronomy facilities under construction, the Square Kilometer Array (SKA), has already estimated the negative impact deriving from Radio Interference coming from satellites, which, although they can be reduced and mitigated, in some bands will end up totally covering the possibility of performing astronomical observations, totally nullifying all the investments made to reveal the astronomical sky at these frequencies of the electromagnetic spectrum, see [11].

In particular, the spectral windows of satellites in low earth orbit designated to provide services and communicate with ground stations in the Ku (12-18 GHz), Ka (27-40 GHz) and V (40-75 GHz) bands will inevitably overlap. to the nominal bands of radio astronomy and therefore will interfere with radio telescopes and radio interferometers on the ground, some of which are already entering a non-linear regime (i.e. they are saturated) in the K band (18.26.5 GHz) and in the Q band (33-50 GHz). This phenomenon constantly compromises (and will compromise even more) the entire chain of analyzes in those bands with unimaginable repercussions on our understanding of the Universe, or even, by making the astrophysics community blind in these spectral windows.

Compounding the matter, with current technological development, it is impossible to predict exactly the planned density of radio frequency transmitters: the millions of new wireless base stations, commercial hot spots on Earth connected directly to future >60,000 new satellites in space, will produce, according to estimates, at least tens of millions of new Radio Base Systems on the ground, supporting more than 200 billion new transmitting objects in the context of the Internet of Things (IoT) by 2020-2025 and a few trillion objects just a few years later.

Such a large number of objects emitting into the radio could make radio astronomy impossible from terrestrial stations without real protection, creating real areas of respect in the countries where radio astronomy structures are located.

In essence, we would like to prevent technological development without serious control from transforming the practice of radio astronomy into an ancient, extinct science.

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**SAS Foundation Association Members can be found here:**
https://docs.google.com/document/d/1x4iaBCGtCWL9q0ntZ5ASdGBz9cHglIybkI5YcLXuuC8
**Stefano Gallozzi declaration can be found here:**
https://docs.google.com/document/d/1tHUsXpaJ3pgKQP-L0MW5GCR11NQj4Mwr_A5XOLIK2iU

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## APPENDIX 5 — Illustrative Table of Relevant U.S. Agency Mission Statements

| Agency | Mission Statement/Relevance |
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| FCC | The Federal Communications Commission regulates interstate and international communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia and U.S. territories. An independent U.S. government agency overseen by Congress, the Commission is the federal agency responsible for implementing and enforcing America's communications law and regulations. |
| State - Office of Emerging Security Challenges | The Office of Emerging Security Challenges (ESC) leads the development of Department positions to enhance space security and missile defense cooperation among allies and partners. ESC also leads the Department's efforts to ensure security in the Polar Regions, and plays a leading role in enhancing cyber strategic stability through enhanced cooperation and the development of confidence building measures as well as the national security implications of artificial intelligence. |
| Department of Justice | To enforce the law and defend the interests of the United States according to the law; to ensure public safety against threats foreign and domestic; to provide federal leadership in preventing and controlling crime; to seek just punishment for those guilty of unlawful behavior; and to ensure fair and impartial administration of justice for all Americans. |
| National Reconnaissance Office (wikipedia) | The National Reconnaissance Office (NRO) develops, builds, launches, and operates space reconnaissance systems and conducts intelligence-related activities for U.S. national security.. The NRO also coordinates collection and analysis of information from airplane and satellite reconnaissance by the military services and the Central Intelligence Agency. It is funded through the National Reconnaissance Program, which is part of the National Intelligence Program (formerly known as the National Foreign Intelligence Program). The agency is part of the Department of Defense. The NRO works closely with its intelligence and space partners, which include the National Security Agency (NSA), the National Geospatial-Intelligence Agency (NGA), the Central Intelligence Agency (CIA), the Defense Intelligence Agency (DIA), the United States Strategic Command, the United States Space Command, Naval Research Laboratory, and other agencies and organizations. |
| Department of Commerce | The mission of the Department is to create the conditions for economic growth and opportunity. (see Remarks by Commerce Secretary Wilbur L. Ross at NTIA's 2020 Spectrum Policy Symposium: Spectrum Sharing for the Next Decade) |

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| NIST (Department of Commerce) | National Institute of Standards and Technology Mission: To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. |
| Federal Aviation Administration (FAA) | Our continuing mission is to provide the safest, most efficient aerospace system in the world. |
| CISA — Cybersecurity & Infrastructure Security Agency | Lead the National effort to understand and manage cyber and physical risk to our critical infrastructure. |
| Office of Management and Budget | The Office of Management and Budget oversees the implementation of the President's vision across the Executive Branch. OMB carries out its mission through four main functions across executive departments and agencies: 1) Budget development and execution; 2) Management, including oversight of agency performance, procurement, financial management, and information technology; 3) Coordination and review of all significant Federal regulations from executive agencies, privacy policy, information policy, and review and assessment of information collection requests; and 4) Clearance and coordination of legislative and other materials, including agency testimony, legislative proposals, and other communications with Congress, and coordination of other Presidential actions. |
| National Aeronautical and Space Administration | To discover and expand knowledge for the benefit of humanity. |
| Office of Science & Technology Policy | The OSTP advises the President and others within the Executive Office of the President on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, and the environment. |
| Food and Drug Administration | The Food and Drug Administration is responsible for protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices; and by ensuring the safety of our nation's food supply, cosmetics, and products that emit radiation. |

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| Environmental Protection Agency | Our mission is to protect human health and the environment. |
| Department of Agriculture | We provide leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management. We have a vision to provide economic opportunity through innovation, helping rural America to thrive; to promote agriculture production that better nourishes Americans while also helping feed others throughout the world; and to preserve our Nation's natural resources through conservation, restored forests, improved watersheds, and healthy private working lands. |
| Labor - Occupational Safety and Health Administration | With the Occupational Safety and Health Act of 1970, Congress created the Occupational Safety and Health Administration (OSHA) to ensure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. |
| Department of the Interior | The Department of the Interior (DOI) conserves and manages the Nation’s natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation’s trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper. |
| House Energy/ Commerce Committee - Jurisdiction | The Committee has the broadest jurisdiction of any authorizing committee in Congress. It legislates on a wide variety of issues, including: health care, including mental health and substance abuse; health insurance, including Medicare and Medicaid; biomedical research and development; food, drug, *device and cosmetic safety*; *environmental protection*; clean air and climate change; safe drinking water; toxic chemicals and hazardous waste; national energy policy; renewable energy and conservation; nuclear facilities; *electronic communications and the internet;* broadcast and cable television; *privacy, cybersecurity and data security*; *consumer protection and product safety*; motor vehicle safety; travel, tourism and sports; interstate and foreign commerce. |
| Senate Commerce, Science and Transportation Committee - Jurisdiction | The Committee messages, petitions, memorials, and other matters relating to the following subjects: Coast Guard; Coastal zone management; Communications; Highway safety; Inland waterways, except construction; Interstate commerce; Marine and ocean navigation, safety, and transportation, including navigational aspects of deepwater ports; Marine fisheries; Merchant marine and navigation; *Nonmilitary aeronautical and space sciences*; Oceans, weather, and atmospheric activities; Panama Canal and interoceanic canals generally; *Regulation of consumer products and* |

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| | *services,* including testing related to toxic substances, other than pesticides, and except for credit, financial services, and housing; Regulation of interstate common carriers, including railroads, buses, trucks, vessels, pipelines, and *civil aviation; Science, engineering, and technology research and development and policy*; Sports; Standards and measurement; Transportation; Transportation and commerce aspects of Outer Continental Shelf lands; The committee shall also study and review, on a comprehensive basis, *all matters relating to science and technology*, oceans policy, transportation, *communications*, and consumer affairs, and report thereon from time to time. |
| National Weather Service | Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy. |
| National Oceanic and Atmospheric Administration | NOAA's Mission: Science, Service and Stewardship. 1. To understand and predict changes in climate, weather, oceans and coasts; 2. To share that knowledge and information with others; and 3. To conserve and manage coastal and marine ecosystems and resources. |
| Cyberspace Solarium Commission | The Cyberspace Solarium Commission (CSC) was established in the John S. McCain National Defense Authorization Act for Fiscal Year 2019 to "develop a consensus on a strategic approach to defending the United States in cyberspace against cyber attacks of significant consequences." |